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ABSTRACT

Testimony on higher education research needs and federal government support is provided, based on joint hearings before the House Subcommittee on Select Education and the House Subcommittee on Postsecondary Education. Attention is focused on the Higher Education Act, except for Title IV. Specific concerns include the following: contributions of higher education and research conducted by large research universities to help meet national needs; the pressing needs for increasing federal funding to universities for research equipment in facilities, particularly in the field of science and engineering; the benefits of basic research to society; the importance of federal support for graduate education; the federal government's role in supporting basic and applied research, as well as research for defense needs; the government's role in helping to identify major research needs in the United States; research activities and needs of Carnegie Mellon University, Pennsylvania State University, and the University of Pennsylvania; Temple University's relationship to the U.S. Department of Education and to the National Institute of Education; and the importance of university research to international interests. (SW)

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RESEARCH NEEDS OF INSTITUTIONS OF HIGHER EDUCATION

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JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON SELECT EDUCATION

AND THE

SUBCOMMITTEE ON POSTSECONDARY EDUCATION

OF THE

COMMITTEE ON EDUCATION AND LABOR HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

HEARING HELD IN PITTSBURGH, PA., DECEMBER 8, 1983

Printed for the use of the Committee on Education and Labor

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RESEARCH NEEDS OF INSTITUTIONS OF HIGHER EDUCATION

THURSDAY, DECEMBER 8, 1983

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON SELECT EDUCATION, AND THE SUBCOMMITTEE ON POSTSECONDARY EDUCATION, COMMITTEE ON EDUCATION AND LABOR,
Pittsburgh, Pa.

The subcommittee met, pursuant to call, at 10 a.m., at the University of Pittsburgh, Law Building, 132 Cathedral Avenue, Courtroom, Pittsburgh, Pa. Hon. Austin J. Murphy (chairman) presiding.

Members present: Representatives Murphy and Simon.

Staff present: Roseann Tulley, staff director, Select Education; William A. Blakey, counsel, Postsecondary Education; John Dean, Republican assistant counsel, Education and Labor Committee.

Mr. MURPHY. Good morning. I'm Austin Murphy, chairman of the Subcommittee on Select Education of the full Education and Labor Committee of Congress.

To my immediate left is Paul Simon of Illinois, who chairs the Postsecondary Education Subcommittee of the full Education and Labor Committee.

We have staff members and are expecting the arrival of two other Members of Congress who serve on our committee.

I want to thank the University of Pittsburgh Chancellor and your aides in the Governmental Relations Office for making these facilities available and for putting so much effort into hosting our hearing here this morning.

I would first like to call upon my senior colleague from the State of Illinois for the opening remarks that will begin the hearing, Congressman Simon.

STATEMENT OF HON. PAUL SIMON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. SIMON. Thank you very much, Mr. Chairman.

It's a pleasure to be here, and it's a pleasure to be at the university and have you provide for us and for your law students what you want to have them understand what is a typical small town, rural country courtroom setting here.

It is a pleasure to be here also with my colleague, Austin Murphy, who is a very active member of the Education and Labor Committee and who has provided leadership which we appreciate on the committee, and I hope the people of Pennsylvania appreciate.

I have just a couple of general remarks before we hear the witnesses, and one is that I'm in the process of drafting the reauthorization of the Higher Education Act, and any ideas that those here or others you come into contact with have in this field we would like as soon as possible, and then once we have the rough draft it becomes public. I assume that will happen around the middle of January, and then we would be interested in your response to that.

I also happened to be reading the New York Times this morning, and on page 15 there is a story from Indianapolis by Ed Fisk about the National Forum on Excellence called by the administration where 2,000 people are talking about how we can improve education, and just above it is a story—the heading says the whole thing—Reagan is set to plan cuts in U.S. fund for education.

Obviously, there is a slight conflict between those two things, the Forum on Excellence and the desire for excellence and the planned cut. I have no idea what they are going to suggest in the field of higher education in your area, Austin. I can only say I am going to once again resist whatever cuts they come along with and, once again we're going to prevail. But the problem is what we end up doing in our subcommittee, at your universities is that we end up fighting for the status quo, and there is no such thing as status quo; we are either moving ahead or we're slipping back.

And instead of dreaming and having a vision of where we ought to go and what we ought to do, we're holding the fort, and that is not where we ought to be.

Anyway, with those generalized remarks—and I hope not too partisan here—I want to thank you again, Austin Murphy, for your invitation to come to Pennsylvania, and I thank you once again for your leadership here.

Mr. MURPHY. Thank you, Mr. Simon.

Our first speaker here this morning will be Dr. Wesley Posvar, Chancellor of the University of Pittsburgh.

STATEMENT OF WESLEY W. POSVAR, CHANCELLOR, UNIVERSITY OF PITTSBURGH

Mr. POSVAR. Thank you very much, Chairmen Murphy and Simon and staff members of the committees.

I am very pleased to welcome you to the University of Pittsburgh and to the city of Pittsburgh and to the moot court that you have noticed here in our school of law.

The very large mural behind you may call for comments. I have inquired as to what the name of it is and it doesn't have a name, but it has a theme, and that is: the truth, the whole truth and nothing but the truth. I am told that not only do you have the Morse code represented there, but that those squiggles are meant to be parts of a polygraph machine. I trust that that large circle is a lense providing truth.

But anyhow, we are very pleased to have you here, and I am also pleased to testify myself, representing my own University of Pittsburgh upon the matter of the Federal Government's support for higher education.

We are going to focus on the Higher Education Act today. We feel, my colleagues and I, that while this is very sound legislation,

it's been a very vital part of American society for the last decade and more; that some redirection or change could strenghten the Act and meet new priorities for higher education in the coming decade and beyond.

We're not going to cover title IV today on student aid, simply because that area requires so very much attention. We will cover some other salient needs.

Because I'm the opening speaker, I'm going to make some general observations about the importance of higher education in our society which I think pertains to what everyone is going to say today.

With reference in particular to your concern about the Federal budget and the quality of education just a moment ago, Mr. Simon. I think it's important to reflect upon higher education as a powerful national asset resource in this country which not only preserves our culture and educates our leaders and so on, but is truly the foundation of our economic and industrial strength and the key to our technological progress.

To the extent that one really believes in national security and national defense and prosperity, then one has to believe in higher education, particularly the most advanced research type, as being central to these national purposes.

The complex research universities of America—of which there aren't very many—are really the theme of our discussion here today, and I think it's very significant that five of those universities are here from Pennsylvania testifying today. They represent a very major proportion of the research capacity of this country.

We all recall the powerful relationship between the Federal Government and higher education in this country, which is different from that of other countries. Beginning with the Morrell Act of 100 years ago or more, the land-grant colleges; the World War II response and the support of university-based research which really was a decisive contribution to winning the war. The reaction to Sputnik, the National Defense Education Act; the drive for equal opportunity which helped create our massive Federal system of student aid; the response to the oil embargo and scarcities and concerns for energy. All have represented major research achievements.

I think that another phase of important response and service by higher education is at hand in terms of our national economic position and productivity.

So I think that in these terms there is an imperative need for revision and change and that the alteration of the Higher Education Act should be perceived in terms of national needs and trends of the 1980's and 1990's.

I want to stress also that we are doing our own part. We are not seeking handouts from the Federal Government. We don't think dollars are solutions in themselves.

The fundamental deficiency that concerns us is basic education. We are, in fact, a nation at risk. I served on a number of panels and boards at the national level and we are looking at all aspects of our economic problems. They all boil down to that original concern with the quality of education and in particular of mathematics and science instruction at the primary and secondary levels upon which everything has to build.

We are beginning to help solve this problem in the colleges by imposing higher college admission standards and progress requirements and by giving technical assistance to our schools.

In Pittsburgh, we have a program of magnet schools of curriculum design assisted by the universities.

I think the important initiatives in dealing with a nation at risk have to be local initiatives in order that they can become complemented and stimulated by Federal programs, such as the mathematics and science education legislation which has recently been reported by the parent committee that you represent here today.

Another spontaneous initiative is a partnership between business and higher education. I am the past chairman of the National Business—Higher Education Forum, which is made up of presidents of major universities and chief executives of major corporations. We get together and we have identified common interests and problems of productivity, high technology and the need for research. Here again, we're working together. We can see the benefit of some assistance from the Federal Government, but we're not asking for masses of money for research. Some incentives which are in place, such as targeted funding might be included in several sections of a revised Higher Education Act.

Title II, the provision of institutional aid, has been traditionally aimed at supporting institutions that serve a low income or underserved population. I think that possibly the concept of institutional aid could be expanded.

We want to applaud and retain what we have, but it could include also the large research institutions whose resources can be deployed to meet national needs, particularly in the form of research.

In our partnership with business, we are also accelerating the benefits of research, and I think this is a very important concept.

In the past, basic research and its application have often been separated by many years or even decades. We can accelerate and benefit society.

We have created, at my university, the Foundation for Applied Science and Technology. We're bringing through this the output of our laboratories into contact with private funds and industry development and we're working on an artificial membrane lung, the computerized stethoscope, new advances in NNR research facilities and so on.

Our collaboration includes other universities. In fact, every one of the five universities here today is connected with one or another of the other in collaborative ways of research.

The University of Pittsburgh is establishing with Carnegie-Mellon University and with our Health Center Hospital an exciting new center involved in basic clinical and medical research, which is going to have national and international impact.

In Pennsylvania as a whole, we have a new, State funded Ben Franklin Partnership which has triggered support by industry, foundations and universities themselves.

Our Western Pennsylvania Advanced Technology Center is projected to stimulate 6,000 new jobs in the next 3 years in this region. This is another case of partnership this time, including partnership with the State government.

So we don't need massive funds, but we do need critical Federal funds.

The question is, besides what we do for ourselves, what are we unable to do, and where is Federal help needed? Here I point out that not more than 60 or 75 American research universities do the majority of the basic research in this country, which is the driving force behind our scientific and technological progress in the future. And as you know, elsewhere in the world, everywhere else, basic research is done mainly in government and private laboratories. This is a unique American institution. Most of this basic research is funded by the major executive agencies, such as defense, energy, health, to the extent of some $5 million a year. But there is a grave deficiency, and you have heard about it before.

Our programs are drastically impeded by our decline in research laboratories and outdated instrumentation. We had Federal funding during the sixties, but that dropped off, disappeared virtually, and I suggest that new facilities could be funded in the future through title VII of the Higher Education Act, and perhaps some other titles.

There are many statistics, but one can say with confidence that our research facilities and instruments in our laboratories in our universities are 20 years behind those of Europe and Japan. Even our American industrial laboratories are behind their competitors in those countries.

We cannot correct our national economic problem until we correct this problem of laboratory equipment and instrumentation.

At my own university—and everyone here can present similar figures—we need to spend, in the next 3 years, over $40 million of new money to provide computer and telecommunications capabilities in order to be competitive. We need $7.5 million in engineering equipment right now, and I could go on and on with many other examples.

There is another area in which I am especially interested in the Higher Education Act, title VI, of which there is a very high need and which requires very few dollars.

This is a funding for support for foreign language and international studies. I think it is essential that title VI be retained and funding levels be increased. I needn't recite the problems in Beirut, Afghanistan, Iran, and so on, and the problems of arms control. But it's clear that we're in an interdependent world. Isolationism is now only a page in history.

And on the campus, the definition of international education itself is extended to involve language and area training to prepare our people to fit into this new complex world arena, and we're doing that. But a very important catalyst of this is the title VI funding. It's presently at $28 million, it came very close to being zero dollars in each of the last 3 years. I argue simply that there can be no better investment in international accord or national security than funding for title VI.

The loss of title VI, should it occur, would be a great boon to our enemies, and its increase would be not only humanitarian, but it would be an act of national defense. The people who believe in national defense should give this top priority.

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We're doing our part at this institution with many foreign area study programs, many linkages. We have 120 visiting scholars here from China, which we are funding with hard money because the Federal Government won't provide the funds. We are doing this because we feel that it is in our vital national interest to have these educational ties with China as well as many other countries, which the Federal Government at this time doesn't support.

We do most of this on our own. Title VI funding is a small, but an indispensable fraction of our support.

So let me just quickly close. I have touched on some topics like science peaking, research instrumentation and foreign area studies. Later in our agenda, the provost of the University of Pittsburgh, Roger Benjamin, will touch upon research of libraries, of graduate education, and my colleagues from the other four universities will reinforce these and other points.

I'd just like to close by saying that the problems that face universities and that face the Nation in the next years interact and are parallel. Increasing productivity, and increasing our balance of trade or military security all require an educated people, a trained work force, a national commitment to youth and to the colleges and universities which prepare them. I think that the Higher Education Act in its next phase can be a cornerstone of that commitment. Thank you.

[Prepared statement of Wesley W. Posvar follows:]

PREPARED STATEMENT OF WESLEY W. POSVAR, CHANCELLOR UNIVERSITY OF PITTSBURGH

Thank you very much, Chairman Murphy and Simon and staff members of the committees. I am very pleased to welcome you to the University of Pittsburgh, to the City of Pittsburgh, and to the moot court here in our School of Law.

The very large mural behind you calls for comment. I have inquired as to its name and it doesn't have one, but it has a theme: the truth, the whole truth and nothing but the truth. I am told that not only do we have the Morse Code represented there, but that the squiggles are meant to be parts of a polygraph machine.

We are very pleased to have you here, and I am also pleased to testify myself, representing the University of Pittsburgh upon the matter of the federal government's support for higher education.

We are going to focus on the Higher Education Act today. My colleagues and I feel that although this is very sound legislation, it has been a very vital part of American society for the last decade and more and therefore some redirection or change could strengthen the Act and meet new priorities for higher education in the coming decade and beyond.

We are not going to cover Title 4 today on Student Aid, simply because that area requires so very much attention. Instead we will cover some other salient needs.

Because I'm the opening speaker, I'm going to make some general observations about the importance of higher education in our society.

In reference to your concern about the federal budget and the quality of education, Mr. Simon, I think it's important to reflect upon higher education as a powerful national asset in this country, a resource which not only preserves our culture and educates our leaders, but also is truly the foundation of our economic and industrial strength and the key to our technological progress.

To the extent that one really believes in national security, national defense and prosperity, then one has to believe in higher education, particularly the type fostering advanced research, as being central to these national purposes.

The complex research universities of America—of which there aren't very many—are really the theme of our discussion here today. It is very significant that five of those universities are from Pennsylvania, and have representatives testifying today. These institutions represent a major proportion of the research capacity of this country.

We all recall examples of the powerful relationship between the federal government and higher education in this country, especially in contrast with that relationship in other countries. Beginning with the Morrell Act over a hundred years ago or more, the land-grant colleges came into being. Then we had the response to World War II, and the support of university-based research which really was a decisive contribution to winning the war. Other examples: the reaction to Sputnik; the National Defense Education Act; the drive for equal opportunity which helped create our massive federal system of student aid; the response to the oil embargo; scarcities and concerns for energy.

Another phase of important response and service by higher education is at hand in terms of our national economic position and productivity.

In these terms there is an imperative need for revision and change. The alteration of the Higher Education Act should be perceived in terms of national needs and trends of the 1980's and 1990's.

I want to stress also that we are doing our own part. We are not seeking handouts from the federal government. We do not think dollars are solutions in themselves.

The fundamental deficiency that concerns us is basic education. We are, in fact, a nation at risk. At the national level, I serve on a number of panels which are looking at all aspects of our ecomomic problems. All of them share a concern with quality, in particular the quality of mathematics and science instruction at the primary and secondary levels upon which everything has to build.

We are beginning to help solve this problem in the colleges by imposing higher college admission standards and progress requirements and by giving technical assistance to our schools. In Pittsburgh we have a program of magnet schools of curriculum design assisted by the universities.

The important initiatives in dealing with a nation at risk must be local initiatives that can become complemented and stimulated by federal programs, for example, the mathematics and science education legislation which has recently been reported by the parent committees that you represent here today.

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We want to applaud and retain what we have, but we should include the large research institutions whose resources can be deployed to meet national needs, particularly in the form of research.

In our partnership with business, we also are accelerating the benefits of research, a very important concept. In the past, basic research and its application have often been separated by many years or even decades. We can benefit society by accelerating application.

At my university, we have created the Foundation for Applied Science and Technology. We are bringing the output of our laboratories into contact with private industry. We are working on an artificial membrane lung, the computerized stethoscope, new advances in NNR research facilities, among others.

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We don't need massive funds, therefore, but we do need critical federal funds.

The question is, besides what we do for ourselves, what we are unable to do for ourselves and where do we need federal help.

Not more than 60 or 75 American research universities do the majority of the basic research, which is the driving force behind our scientific and technological progress. This is a unique American institution, for as you know elsewhere in the world, everywhere else, basic research is done mainly in government and private laboratories.

Most of this basic research is funded by the major executive agencies, such as Defense, Energy, Health, to the extent of some $5 M a year. But there is a grave deficiency. Our programs are drastically impeded by our decline in research laboratories and outdated instrumentation. We had federal funding during the Sixties, but that dropped off, virtually disappeared. I suggest that new facilities could be funded in the future through Title VII of the Higher Education Act, and perhaps some other Titles.

There are many statistics, but one can say with confidence that our research facilities and instruments in our laboratories in our universities are twenty years behind those of Europe and Japan. Even our American industrial laboratories are behind their competitors in those countries.

We cannot correct our national economic problem until we correct this problem of laboratory equipment and instrumentation. At my own university—and everyone here can present similar figures—in the next three years we need to spend more than $40 M of new money to provide computer and telecommunications capabilities in order to be competitive. We need $7.5 M in engineering equipment right now, and there are many other examples.

I am especially interested in another area of the Higher Education Act, Title VI, of which there is a very high need and which requires very few dollars.

This is a funding for support for foreign language and international studies. I think it is essential that Title VI be retained and funding levels be increased. I need not recite the problems in Beirut and Afghanistan or Iran, or the problems of arms control. It is clear that we are in an interdependent world. Isolationism is now only a page in history.

On the campus, the definition of international education itself is extended to involve language and area training to prepare our people to fit into the new complex world arena. A very important catalyst of this is the Title VI funding. It is presently at $25.8 million, and came very close to being zero dollars in each of the last three years. I argue simply that there can be no better investment in international accord or national security than funding for Title VI.

The loss of Title VI, should it occur, would be a great boon to our enemies, and its increase not only would be humanitarian, but also would be an act of national defense. The people who believe in national defense should give this top priority. We are doing our part at this institution with many foreign area study programs through many linkages. We have 120 visiting scholars here from China, whom we are funding with hard money because the federal government will not provide the funds. We are doing this because we feel that it is in our vital national interest to have these educational ties with China as well as many other countries. The federal government at this time does not provide this support. Title VI funding is a small, but indispensable fraction of our support.

In sum, I have touched on some topics like science teaching, research instrumentation, foreign area studies. Later in our agenda, the Provost of the University of Pittsburgh, Roger Benjamin, will touch upon research of libraries, of graduate education, and my colleagues from the other four universities will reinforce these and other points.

I would just like to close by saying that the problems facing universities and facing the nation in the next years interact and are parallel. Increasing productivity, increasing our balance of trade or military security, all require an educated people, a trained work force, a national commitment to youth and to the colleges and universities which prepare them. I think the Higher Education Act in its next phase can be a cornerstone of that commitment. Thank you.

Mr. MURPHY. Thank you, Dr. Posvar.

I just wanted to add some comments and will perhaps have a question or two to ask of you.

During the last year a great deal of attention, of course, has been devoted to the quality of education of Americans. We hardly read a newspaper or listen to radio or television without hearing about

the condition of education and receiving recommendations for improving our educational system.

Recently, greater attention has been placed on the educational needs of institutions of higher education, which is what we're concerned with here this morning.

It has been discovered that the quality of education in our colleges and universities also is being subjected to some question. Professors are leaving teaching positions for higher-paying positions in the private sector. Achievement test scores of graduate students have been in some areas declining during the past 20 years. The demand for improved, sophisticated, modern equipment and instrumentation has far exceeded the funds available for institutions to purchase this equipment. Many of our graduates are finding they are not adequately prepared to enter into today's work force and those being offered positions are finding the need to be retrained to meet the needs of our technological society which is developing. Even our universities' research library collections are unable to keep up with the rising cost.

Since the 1970's expenditures for library materials have risen 91 percent, resulting in a decrease in the growth of library materials that are so valuable to research and institutions.

We're also hearing reports that research facilities in Japan and West Germany are now exceeding our institutional facilities here in the United States.

As we begin looking forward to the reauthorization of the Higher Education Act and the National Institute of Education, we must begin to investigate the problem areas which have been cited.

This administration has stated that education should be our Nation's No. 1 priority—contrary to this morning's newspaper—and yet during the past 2 years, over $2 billion for educational support has been cut from the Federal administration budget.

Just yesterday, Secretary Bell reaffirmed the administration's support for education, and, yet, indicated they would not be recommending any increases in Federal support. Where is the administration stated priority today as we learn that they may be asking for a reduction in the necessary education funding.

The defense, security, and stability of our country is dependent upon its people, and without a quality education system, our superiority as a nation will be lost. Our investment in education will insure us the returns of maintaining our Nation's strength and reputation as a world leader.

By lessening the Federal Government's investment in the educational research needs of institutions and students of higher education, are we going to jeopardize our achievements and excellence as a nation itself?

During the hearing today we will be receiving other testimony, and I would hope that all of you who are representatives of Pennsylvania's major postsecondary research institutions, can address these needs which we think are typical of the Nation.

Witnesses will be testifying on the condition of research facilities within institutions, offering suggestions for improving postsecondary research, identify whether or not the role of the National Institute of Education needs to be expanded to place greater emphasis

on higher education and what role the Federal Government should have in institutional research.

So with that, I will ask Congressman Simon if he has questions of the Doctor, and then we will take our first full panel from the other institutions.

Congressman.

Mr. SIMON. Yes, just a few quick comments on your remarks, which I appreciated.

First of all, title VI, you could not be more on the mark of what is needed. And in this connection, I might add that it is so clearly in the Nation's interest.

So far as I can determine—just to use one example, and many could be used—when we got involved in Vietnam, in the Defense Department, State Department, all the great universities of this country, we had a grand total of two American-born specialists who understood the language and culture of that area. If we had had the good sense to invest a few dollars, we could have had 10, 20, or even go wild and had 50, we might not have had 3 million Asian lives lost and 57,000 American lives lost and the scars of our society here today.

I was also pleased to note your stress on international exchange. What is happening is, we are as a nation spending more and more on what is destruction and less and less to understand each other.

In the last 3 years, roughly 80 American colleges and universities, for example, dropped teaching Russian. I don't know what the situation is at the University of Pittsburgh, but nationally we have a declining percentage of faculty members teaching and studying abroad, and that simply cannot be in the best interest of the American higher education or of the Nation.

And if I can just stretch your imagination just a little bit here. Imagine that 50 years ago that Urie Andropov was an exchange student for one year at Eureka College in Illinois and Ronald Reagan was an exchange student for 1 year at the University of Moscow, I think we would be living in a different world today.

We don't know what the future of the Urie Andropov and the Ronald Reagan's are, but we ought to be building bridges of understanding, and we're not doing it like we should. So I commend you.

The area that you touched on that is a problem area, I'm not sure how we're going to be approaching this, this whole problem of how we fund physical research facilities.

I faced this very practical problem as I put together the reauthorization of the Higher Education Act, and that is, I want to expand some of the programs. We are considering, and I have to obviously check with my colleagues on what we're going to be doing, but we're thinking about making an entitlement of the Federal grant program; we're thinking about the possibility of adding the first year of graduate school as eligible for the program.

But when you get into the physical research facilities, you're talking about dollars that are so great, that when you add that to the other things that we hope to do, that bottom line gets too heavy for us. So I have kind of tentatively thought about shifting much of that burden in the National Science Foundation, and maybe that's just passing the buck here, I don't know.

We have also talked about some Federal incentive to encourage endowment growth at your university, and that would help all schools, not only the research schools.

We do want to encourage library support more and, clearly, that's something that we ought to be thinking about. And we have talked about the possibility of some low-interest loans that would be available to your schools for this purpose.

Now I guess my question really is three questions; one, would encouragement in endowment expansion be helpful; two, is my thinking wrong about saying we ought to have the National Science Foundation or someone else pick up the tab on much of the systems for physical research facilities; and, three, would low-interest loans be of practical help or is that simply postponing facing reality?

Mr. POSVAR. Well, Mr. Chairman, I think that all three of those are very excellent suggestions, because they represent a sharing of responsibility and a cost-effective approach.

Anything that can foster endowment, tax incentives and others, would be enhancing the abilities of the institutions to control their own fate and enable them to take their own initiatives. I think endowment is a superb strategic objective.

As for the burden of the financing of improving laboratories and instrumentation, I present these points essentially as a gross national profit. I think there is a very sensitive question as to how this should be distributed. In my view, these are a critical national security need as well as a national economic need, and I think that there would be every rational justification for the Defense Department and for the Energy Department as well as NSF to contribute a major share. As a matter of fact, I think the NSF's overall mission is very parallel to the goals of the research universities that are represented here today. So I think that any distribution of that load would be beneficial; in fact, would be desirable, because the load, as you point out is very enormous. If it were placed entirely on the Education Act it would overwhelm us.

In terms of low-interest loans I think, once again, this is a way for the Federal Government to assist in ways that foster the mission of local institutions, and the strength of our research universities is derived very much from the fact that they are autonomous institutions that foster free inquiry, and to the extent that they can deploy their own resources, stimulated by the Federal Government, enhanced by it, I think is a very wise course to follow.

Mr. SIMON. I thank you, and I thank you for being here this morning.

Mr. MURPHY. Thank you, Dr. Posvar, we appreciate your being with us.

We would like to have then at the conference table the following representatives: Dr. Bryce Jordan, president of the Pennsylvania State University; Dr. Sheldon Hackney, president of the University of Pennsylvania; Dr. Edward Schatz, senior vice president of Carnegie-Mellon University; Ms. Barbara Brownstein, vice president of academic affairs of Temple University; Roger Benjamin, provost, University of Pittsburgh.

We thought what we might like to have you do is we would proceed in order with your statements and then we can sort of shoot

down questions to you as a panel. Like Mr. Simon and myself, when we get stuck, you too have some learned person next to you to ask.

We will proceed then with Dr. Jordan of Penn State.

STATEMENT OF BRYCE JORDAN, PRESIDENT, PENNSYLVANIA STATE UNIVERSITY

Mr. JORDAN. Mr. Chairman and members of the committee, I welcome this opportunity to testify before you today on the research needs of institutions in higher education.

I want to focus primarily on the pressing needs for increasing Federal funding for research equipment in facilities, particularly in the field of science and engineering.

The Pennsylvania State University is among the top 20 research and development universities in the Nation, yet along with other major research universities across the country, it's suffering the consequences of inadequate Federal funding for the purchase of facilities and equipment.

We are behind in keeping the university at the state-of-the-art in engineering and scientific equipment. The facilities that we have to house that equipment are in many instances outdated and inadequate.

Upgrading our equipment and facilities is Penn State's single most pressing need for substantial funding support. It is becoming increasingly critical.

I know this is not news to you. It is a national problem that has been growing for years.

In 1970, for example, the National Science Board commissioned a national study on the status of instrumentation in university research laboratories. At that time, a need for $200 million in new instrumentation was demonstrated. By 1980, the combined increases in the consumer price index and instrumentation costs put the accumulated need at at least $1 billion.

There is consensus in the academic and industrial communities that, in the long run, this problem could undermine the Nation's technical effort, endangering both our security and our economic well-being.

In the shorter term, it is impacting negatively on scientific research and the training of graduate students; those same young people we expect to compete effectively in the international economy.

The problem, as I noted earlier, is well documented. In 1981, Penn State cooperated in the preparation of a study for the Association of American Universities called The Nation's Deteriorating University Research Facilities.

The study surveyed 15 leading universities, including Penn State as well as, among others, the University of California at Los Angeles, Stanford University, the Massachusetts Institute of Technology, and the Universities of Wisconsin, Utah, Maryland, and Illinois.

The research team focused on six scientific fields: biological sciences, chemical sciences, earth sciences, engineering, physics and, where applicable, medical schools.

Here's what they found: a substantial backlog of research facilities and equipment needs is accumulating in many of the science and engineering departments surveyed; projected funding needs for university research laboratories and equipment for the next 3 years equaled almost twice the level of expenditures for the previous 4 years; institutions are unable to provide the equipment of facilities necessary for basic science and engineering researchers and students to conduct state-of-the-art research and education programs; the loss of Federal contributions to the support of research facilities and the absence of compensatory sources of support have forced many institutions to renovate and repair only a few of those facilities in greatest need.

The consequences of all this are diminished research productivity, reduced training capacity, and decline in our international competitive status.

At Penn State, we have not found adequate solutions to the problem. The university in the past has been able to scrape together about a half a million to a million dollars each year to fund internal requests for equipment funding throughout the Penn State system.

I would like to put that in perspective for you by explaining that the total value of the university's research and teaching equipment is about $85 million—that's equipment. If that were updated and replaced over 5 years—a very conservative goal—at approximately 20 percent a year, we would need $17 million per year to do it.

So, essentially, what we have been doing is throwing less than a million dollars a year at a $17 million problem. We obviously are drawing down on our laboratory capabilities instead of keeping them up to date.

As we each year allocate what we have available for internal equipment requests, the requests far exceed the funds to meet them. I'm speaking here about, by the way, legitimate requests, not wish lists.

Our academic units are directed each year to limit equipment requests to their essential and specific needs.

Last year—which was a difficult one for Penn State—we had only about $450,000 available to fund those needs.

Our internal requests for essential research equipment totaled $2.7 million that year. These numbers then represent a huge and unmet need, and this is made even worse by the ever-present technology advance that we see going on in this country.

For the 1982-83 academic year, we were able to fund only 11 percent of the $258,000 our college of engineering requested for essential research equipment.

In our college of science, we funded 11.3 percent of that college's $459,000 request.

And that doesn't address either college's need for classroom instructional equipment, let alone other needs across the university.

In our college of agriculture, for example, we're working with a dairy unit that is 30 years old. I might add that it is not unusual for universitywide requests for essential classroom instructional equipment to exceed requests for research equipment.

The realities of the situation are such that in many cases a great deal of our instructional equipment would not be at Penn State

were it not for our strong research program. Government agencies and industry are helping us with equipment.

Penn State s sponsored research projects total about $60 million each year on a direct cost basis. Research equipment is budgeted in most of these sponsored projects and such equipment purchases exceed those based on university funds.

Many of our teaching laboratories and graduate student thesis projects are literally dependent on this trickle-down source of equipment.

We want to say also that last year, the Instrumentation Grant Proposals administered by the Department of Defense were encouraging. This matching-funds program last year triggered 26 Penn State proposals for $6.8 million in new instrumentation. And our success rate was gratifying. Five proposals were funded with $746,000 of DOD money and $431,000 from Penn State matching funds. This enabled us to acquire $1.18 million of badly-needed equipment.

And, as you know, DOD will have about $20 million to be distributed for instrumentation grants over the next 2 years, but requests for that money are estimated to be over $1 billion.

We appreciate, too, that the National Science Foundation has added resources into their equipment grant program this year. While these steps are encouraging, we need far more support if the Nation's research universities are to meet their responsibilities adequately.

In our research facilities and equipment, we have not been able to catch up with changing technology and rising costs. The old ways are simply not working.

Every year our need for equipment becomes greater while the life of that equipment gets shorter. We need your continued understanding and support, particularly in relation to title VII of the Reauthorization of the Higher Education Act.

Title II of the act also will be important to Penn State. We would like your support for title II-C, Strenghtening Research Library Resources. However, we would like to see more flexibility in the program so that funds are allocated to assist more libraries raise the level of scholarly materials available. A good research library is crucial at a research university.

I would like to add that programs to develop the finest university research facilities and equipment in the world will be for naught if we do not make it attractive for students to use.

As you know, the number of Federal fellowships to graduate students across the country has fallen from approximately 51,000 in 1968 to 9,000 in 1983.

As your colleague William D. Ford noted in a recent address to the Association of American Universities, inadequate financial aid, combined with a difficult job market, is threatening to erode the quality of scholarship and teaching in the arts and—not only in science and engineering—but in the arts and humanities as well.

While the focus of our testimony here is on science and engineering, more than that is at risk in higher education today.

We must be certain that we consider this carefully in title IX—Graduate Programs. In this regard, Penn State has used the Grad-

uate and Professional Opportunities program successfully and would like to see that program maintained and expanded.

Before concluding, I would like to express Penn State's continued support for the National Institute of Education. We have been concerned about NIE's deteriorating funding base in recent years and are pleased by what appears to be an increasing concern there for postsecondary education.

I would like to thank the leadership on the Hill for its support of NIE and commend the work of its director, Dr. Manual J. Justiz. Thank you very much, Mr. Chairman.

Mr. MURPHY. Thank you very much, Dr. Jordan.

[Prepared statement of Bryce Jordan follows:]

PREPARED STATEMENT OF DR. BRYCE JORDAN, PRESIDENT, THE PENNSYLVANIA STATE UNIVERSITY, PITTSBURGH, PA.

Mr. Chairmen and members of the committees, I welcome this opportunity to testify before you today on the research needs of Institutions of Higher Education, I want to focus primarily on the pressing needs for increased federal funding for research equipment and facilities, particularly in the fields of science and engineering.

The Pennsylvania State University is among the top 20 R&D universities in the nation. It, along with other major research universities across the country, is suffering the consequences on inadequate federal funding for the purchase of facilities and equipment. We are behind in keeping the University at the state-of-the-art in engineering and scientific equipment. The facilities we have to house that equipment are, in many instances, outdated and inadequate. Upgrading our equipment and facilities is Penn State's single most pressing need for substantial funding support. It is becoming increasingly critical.

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The problem, as you know, is well documented. In 1981, Penn State cooperated in the preparation of a study for the Association of American Universities called The Nation's Deteriorating University Research Facilities. The study surveyed 15 leading universities including Penn State as well as—among others—the University of California at Los Angeles, Stanford University, the Massachusetts Institute of Technology, and the Universities of Wisconsin, Utah, Maryland, and Illinois. The research team focused on six scientific fields: biological sciences, chemical sciences, earth sciences, engineering, physics, and, where applicable, medical schools.

Here's what they found: A substantial backlog of research facilities and equipment needs is accumulating in many of the science and engineering departments surveyed; Projected funding needs for university research laboratories and equipment for the next three years equaled almost twice the level of expenditures for the previous four years; Institutions are unable to provide the equipment or facilities necessary for basic science and engineering researchers and students to conduct state-of-the-art research and education programs; and The loss of Federal contibutions to the support of research facilities and the absence of compensatory sources of support have forced many institutions to renovate and repair only those facilities in greatest need.

The consequences of all this are diminished research productivity, reduced training capacity, and decline in our international competitive status.

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I would like to put that in perspective for you by explaining that the total value of the University's research and teaching equipment is about $85 million. If that were updated and replaced over five years—a very conservative goal—at approximately 20 percent a year, we would need $17 million per year to do it. So, essentially, what we have been doing is throwing less than $1 million a year at a $17 million problem. We obviously are drawing down on our laboratory capabilities instead of keeping them up to date.

As we each year allocate what we have available for internal equipment requests, the requests far exceed the funds to meet them. I am speaking here about legitimate requests, not wish lists. Our academic units are directed each year to limit equipment requests to their essential and specific needs. Last year, a difficult one for Penn State, we only had about $450,000 available to fund those needs. Our internal requests for essential research equipment totaled $2.7 million. These numbers represent a huge and unmet need. This is made worse by ever-present technology advances.

For the 1982-83 academic year, we were able to fund only 11 percent of the $258,000 our College of Engineering requested for essential research equipment. In our College of Science, we funded 11.3 percent of its $459,000 request for essential research equipment. And that doesn't address either college's need for classroom instructional equipment, let alone other needs across the University. In our College of Agriculture, for example, we're working with a dairy unit that is 30 years old! I might add that it is not unusual for University-wide requests for essential classroom instructional equipment to exceed requests for research equipment.

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concern there for postsecondary education. I would like to thank the leadership on the Hill for its support of NIE and commend the work of its director, Dr. Manuel J. Justiz.

Thank you very much.

Mr. MURPHY. Dr. Hackney of the University of Pennsylvania.

STATEMENT OF SHELDON HACKNEY, PRESIDENT, UNIVERSITY OF PENNSYLVANIA

Mr. HACKNEY. Let me say, Mr. Chairman and Mr. Simon, at the outset how pleased I am to be here and, in addition, how much your earlier remarks—both as to the identification of comments and your statements of principles—have made me feel very much that I am among friends. Not only are we living in the same world but, happily, appear to be going in the same direction. So I begin on a very encouraging note.

I am, of course, the head of a major research institution, the University of Pennsylvania. Our research budget is $128 million in the current year; $83 million of that comes from the Federal Government.

As you look among research universities in the country, we rank No. 10 in the use of Federal dollars for basic research. And if you look only at the biomedical sciences, we rank No. 5.

So I greet you this morning, not only as a citizen and a constituent but, indeed, as a partner in the research enterprise. And it is heartening to know that we are seeing the problems in the same way.

I would like to make just one or two points that have just been touched on before and that I think will probably be shared by most of us here this morning.

One is that the basic research that we do, even though its benefits are sometimes distant and difficult to locate, are real, and that they do redound to the benefit of society.

Let me cite just one or two very interesting examples that caught my layman's eye at the University of Pennsylvania. Dr. Chris Lambertson, who is the head of our Institute for Environmental Medicine, has been working for years on how humans survive under very extreme conditions. The work that is now being done in the space lab, the humans that are orbiting the Earth under extreme conditions have benefited; the NASA program in general has benefited; the man-in-space flights have benefited from his work, and also our ability of humans existing at extreme depths beneath the sea has benefited from his work. So our ability to recover minerals from the depths of the ocean is going to be made more possible by the work of that scientist working with Federal support.

Further, there is a professor in the nursing school who is doing research now on neonatal problems to see if it might help the survival rate and the other health indices of newborn infants for them to be taken home more early or more quickly than they now are.

One could go on. Last year one of our veterinary scientists, Dr. Ralph Brenster, found for the first time a way to manipulate an individual gene in the genetic structure of animals. He was working with rats actually, and he was able to manipulate the growth and to replace the growth of the gene that controls the excretion of

growth hormones in rats, so that the second and third generation of rats in his sample were much, much bigger than the first rats.

Now, you might wonder why having bigger rats is important, but if he can do that with rats, he can do it with food animals as well. And the prospects of the benefits of that for mankind, in general for our agribusiness here in the United States, is very obvious.

At the same time another team of scientists, participated in by Dr. Andy Benz and other scientists from other universities, was doing the same thing in the area of plant genetics, being able to manipulate an individual gene in a plant and where that may lead for the production of plants that yield more food, that are resistant to strains of disease, and so on in just unlimited.

On a more practical level, we had some dental scientists who invented a new set of braces that apply electrical stimulation to the teeth and the gums as they are worn, and this cuts down by about one-third—or to about one-third the time that a young person—or any person—must wear braces in order to correct the position of their teeth. If you have a child undergoing orthodonic treatment now, the importance of that in human suffering and expense is quite evident.

One can go on. We're doing a lot of work in nuclear magnetic residence now. A handful of teams around the country are doing that, and it's the most exciting new diagnostic tool to come along since the beginning of medical imaging, indeed.

One could go on and on and on about the way in which basic research eventually will redound to the benefit of mankind in various ways.

I want to state—or to restate, since it has been touched on before—something about the role of the Federal Government in higher education. Now being an expert in primary and secondary education, I'll try to stay away from that, but it seems to me that there are two principal roles and a third role in addition to that; but the two principal roles are quite clear and they have been developed over a long period of time by the Congress and that is to provide access to higher education for every young person or every person in the United States who can benefit from that sort of education as a matter of both choice and access is very important.

Those principals are now embedded in Federal legislation and they're extremely important, not only from the point of view of equity, providing an equal chance for what education can do for one's happiness and one's productivity in life, but also from the point of view of education environment on college campuses across the country. That diverse student body is very important to us at the University of Pennsylvania, and I'm sure that's true with my colleagues elsewhere.

We would like to have students from various backgrounds; various geographic backgrounds; various economic backgrounds; various ethnic backgrounds. Without the various Federal support that is provided by the various student aid programs we would not be able to do that.

So I must say those programs, as you know, have been declining over the past 10 years in real dollars and that's of grave concern.

We have been aware mostly in the past with the application of those funds to undergraduates—though some of those programs

also help graduate students—I felt very encouraged by Mr. Simon's remark about the possibility of extending the Federal grants to first-year graduate students.

We have been unconcerned—or a little less concerned in the past because graduate education has been in something of a dip—it's like given the structure of the demographic curve, the number of students coming into graduate programs—that is, Ph. D. programs—has been going down in the last 5 to 7 years because we needed fewer of those in academic positions. That has now changed, it's time for us to start ginning up again and producing the future faculty, the future scientists of our research efforts in the 1990's, which students entering now are going to be ready to start producing in the 1990's when we need them.

And that has begun to happen. This year for the first time there has been a broad-scale upturn in the enrollment in graduate programs across the country.

So paying attention to support for graduate education is very important.

The third reason for that, of course, is that graduate education and research enterprise go hand in hand. You can't do one very well without doing the other.

Now the second role in which the Federal Government has a key role, of course, is in supporting basic education. In the area of financial aid, there is no other source of the dollars needed to provide access and choice for America's young people than the Federal Government. The same is true with basic research, there is no other source of the dollars that are needed to keep us in the lead in the world in basic research, and, therefore, not only to protect us in our defense efforts and make us more secure because they have a strong economy, but to keep our economy at the forefront, which is going to be necessary.

Also, not only is the magnitude of the dollars great, but the payback of basic research is very diffuse. It spreads all over society, it can't be captured by any one person, and the payback period is 15 to 20 years in some cases. And there is no other agency, private agency, in the country that is going to pick that up.

So the Federal Government has the major role there.

And beyond those two areas, I think the Federal Government does have a role in providing leadership in identifying major educational and research problems in the country. In most of these areas, I would not expect the Federal Government to try to solve those problems by itself, but it can provide leadership, it can provide seed money, it can make sure that a model can exist that can be copied by other people with other funds.

In that regard, I think the title VII programs are very important. You have already touched upon those, and I will support that. Title VII and title 2-C, Research Library Support, would be areas in which the Federal Government can't possibly solve the whole problem, but it can provide leadership.

There are other areas as well that would fall in that category.

But I want to especially emphasize what has already been said by Chancellor Posvar and by President Jordan about the primary need that we have now to renew our research capacity through

reequipping laboratories, reinstrumentation, and also through facilities, of providing funds for facilities.

Here I think probably enough has been said. It's a serious problem throughout higher education and that is certainly true at the University of Pennsylvania. If we're going to get the full benefit from the research programs that are being funded and stimulated by the Federal Government, we need the equipment and the facilities in which to do it in, or we will be doing it only at half speed.

If I may venture an opinion about how this might be done, I think that it needs to be done mostly in support for reinstrumentation and support for building facilities; needs to be done broad-scale throughout all of the agencies of the Federal Government that support research; not only NIH and NSF, but the Department of Energy, the Department of Defense, and through other programs.

So a broad-scale attack on this problem is the only thing that will succeed. So I associate myself with the evidence already presented by President Jordan and will urge the Congress to respond to this very critical need. Thank you.

[Prepared statement of Sheldon Hackney follows:]

PREPARED STATEMENT OF SHELDON HACKNEY, PRESIDENT, UNIVERSITY OF PENNSYLVANIA

Chairman Murphy, Chairman Simon, Congressman Harrison, I very much appreciate your invitation to testify before you regarding the research needs of higher education, and to join with my colleagues in commenting on the relationship between the Federal government and research universities in meeting those needs.

I speak from the perspective of one of our nation's premier research universities—the University of Pennsylvania. The University's history predates the establishment of our Federal government, but its recent history, particularly since the Second World War, has seen an increasingly close involvement with Washington. Among the nation's universities, Penn ranks tenth in the total amount of Federal support for research and development activities, and fifth in support of biomedical research from the National Institutes of Health. To illustrate the importance of the Federal government in Penn's research activities, in University fiscal year 1983, approximately 85 percent of Penn's research funds were provided through Federal sources. Similarly, the lion's share of Penn's total Federal support—83 percent in University fiscal year 1983—is for sponsored research. Federal research funds available to the University amounted to $83.4 million in that fiscal year. Obviously, the Federal government has a considerable stake in the success of the research enterprise at Penn, and the University has a strong interest in the continuation and extension of Federal research support.

I must underscore my view that our nation has substantial needs for the product of University research. To meet these needs, which translate into substantial benefits to our society, is a critically important part of higher education's mission. The usefulness of the sponsored research conducted at our universities is not always immediately evident, yet I am constantly impressed by the degree to which the investment of the Federal government in the research enterprise at Penn has been multiplied in terms of tangible benefits to the people of our nation. To cite just two of many examples, our Institute of Environmental Medicine has, since the Second World War, been perhaps the nation's premier facility for basic and applied research on the tolerance of man to environmental extremes. This research has been instrumental in NASA's development of the manned space flight program and in developing industrial applications of undersea mineral recovery technology. Penn's School of Nursing is conducting NIH-sponsored research into alternative forms of care for premature infants to consider whether early discharge and home followup by neonatal nursing specialist may be more effective, in terms of family bonding, decreased family stress, decreased susceptibility to infection, and cost, than acute hospital care for these infants.

My statement will center on the needs of institutions of higher education generally, and of Penn specifically, for concerted Federal support for academic and research facilities and programs, but I would be remiss if I did not comment on the critical importance of that "other" 17 percent of Federal support for the University—sup-

port for student financial assistance and postgraduate training. Chairman Simon, I know particularly of your great interest in, and advocacy of, a strong Federal program of student financial aid, and I commend you for your efforts and successes in that area. Indeed, Penn students, and tens of millions of other students throughout the nation, have been the beneficiaries of the quarter century of Federal programs in support of students, beginning with the National Defense Education Act of 1958. The principles which have guided the Federal student aid programs—the principle of access affording students, without regard to economic circumstance, the opportunity to participate in higher education, and the principle of choice, affording students, based on their ability, the opportunity to select the institution which best suits their needs—should remain the keystones of Federal student aid policy.

These principles, put into practice through the Federal student aid programs, have substantially enhanced the economic and cultural diversity of Penn's student body, and have thereby helped immeasurably to strengthen the fabric of the University. Thousands of economically disadvantaged and middle class students, who would not otherwise have had the opportunity for a Penn education, have been able, with Federal aid in the form of grants, work assistance, and loans, to attend Penn. This Federal assistance is not merely an investment in the University, but is an investment in human capital which will bear fruit in a broadly educated, technologically literate and ethically sensitive citizenry.

Yet the increased cost of providing higher education, at Penn and at our sister institutions, combined with the leveling off of Federal student aid during the past few years, has widened the gap between cost and available student resources. In University fiscal Year 1983, our students received $8.1 million in student aid authorized under Title IV of the Higher Education Act (exclusive of Guaranteed Student Loans). This represents, in 1972 constant dollars, an erosion in Federal student aid of more than 50 percent. Therefore, we deeply appreciate the recent actions of the Congress in appropriations legislation for fiscal year 1984 to provide significant increases in student aid, particularly in the Pell Grant program, and hope that this trend will continue. Penn, too, is doing its share to maintain its commitment to need-based aid, and to provide for equitable and stable financing of a Penn education, in our new "Penn Plan", which will be financed through other than Federal sources. But the Federal government must continue to play a leadership role in its partnership with students, parents, States, and institutions in assisting students in their pursuit of higher education. An effective student aid program is critical to maintain the steady flow of students who are at the core of our research effort.

GRADUATE STUDENT TRAINING

The most direct linkage between student financial assistance and the university research effort is in the academic training of graduate students. Graduate student assistance is essential both to the conduct of current research and to the development of a cadre of university faculty who will, in turn, teach the succeeding generation of researchers and faculty. The reduction of Federal support for graduate training at Penn over the past five years has been alarming, and is illustrative of a national trend which will, if not arrested and reversed, have a debilitating effect on the future conduct of research in the United States.

Most graduate aid for Penn students comes from the Public Health Service of the Department of Health and Human Services. This assistance, in the form of scholarships, traineeships, fellowships, and loans, has declined steadily since 1979, from $10 million to $7.4 million.

Federal aid for graduate study and research in the humanities has been even more sparse. The demise of the foundation-supported Ford, Woodrow Wilson, and Danforth fellowship programs which helped promote humanities graduate study has left a huge void, one which seriously threatens the necessary development of a "critical mass" of scholars in these areas. Countless undergraduate students of exceptional promise in the humanities have chosen not to pursue teaching careers in the fields of history, literature, foreign languages, and other humanities disciplines due to a general lack of financial support, uncertain employment prospects, and low salaries. Rather, they have opted for study toward careers in the professions—law and business, particularly—which hold the prospects of greater and more immediate pecuniary rewards. While there may have been a "glut" of teachers in the humanities disciplines in the recent past, such is not expected to be the case at the end of this decade and into the 1990's. The pervasive lack of financing for graduate education in the humanities could well mean a lost generation of scholarship and teaching in these disciplines, which are as essential to the fabric of higher education as training in the sciences. It is imperative that Congress reauthorize, and adequately fund, pro-

grams such as the National Graduate Fellowships, commonly known as the Javits fellowships (Title IX, Part C of the Higher Education Act), if we are to sustain excellence in humanities scholarship.

ACADEMIC AND RESEARCH FACILITIES

The development of new technologies has historically been founded in basic research, 70 percent of which is conducted on college and university campuses. If we are to retain and extend our nation's leadership in science and technology, the research capacity of our universities must be strengthened.

During the past decade, Federal support for basic research has declined dramatically in real terms. Furthermore, the recent history of Federal funding for basis research has seen a major shift in direction—away from the biomedical field, in which major breakthroughs with Federal support, have been made by universities, and toward the physical sciences and defense research efforts, which tend to be less campus-based. I therefore highly commend the Congress for stemming the decline in basic biomedical research support in enacting the fiscal year 1984 appropriations legislation for the National Institutes of Health, which increased NIH funding by 12 percent.

Even if this fiscal year 1984 increase in biomedical research support, coupled with a concomitant increase in basis research support for the physical sciences through the Department of Defense, is the beginning of a much-needed trend, there remains for our research universities the acute problem of aging, outmoded, and overutilized research facilities and equipment in which to carry out sponsored research. On average, university research facilities, equipment, and scientific instrumentation are twice as old as those of industry.

Without the renovation and replacement of antiquated research facilities and equipment, the conduct of basis research in our universities can only proceed at half-speed, at best. In the 1940's and 1950's, the Federal government, at Congress' behest, embarked on a series of ambitious programs of support for health-related and other scientific research facilities. These programs of construction reached full fruition in the 1960's. Since 1948, when the first specific appropriations were made available through the National Cancer Institute and the National Heart Institute, research construction funds from the National Institutes of Health have totaled $834 million: only 4 percent of this total has been appropriated in the past 5 years, only 17 percent in the past decade. More than 95 percent of all funding since 1968 has been specifically for the construction and renovation of cancer research facilities.

The sole general authority for health-related research construction, the Health Research Facilities Act of 1956, was instrumental in developing our biomedical research capacity. Funding for that program, which totaled $483 million, was halted in 1968, and the program was repealed in 1974. According to a recent NIH analysis "it has been 15 to 26 years since institutions received federal support under this program. During this time, research laboratory requirements have changed, brought about by the growth in the knowledge base, the development of new technologies, more effective handling and processing of information, and requirements for higher standards. Research space of two decades ago, for the most part, cannot accommodate research requirements today without major renovation or replacement." The Association of American Universities, in 1981, surveyed 15 of its member institutions and found that these schools would need $765 million for research facilities and equipment during the succeeding three years merely to maintain their existing level of research activity.

Although I have focused on biomedical research, since that is the area in which Penn has its most considerable research relationship with the Federal government, I should note that Federal support for academic and research facilities through Title VII of the Higher Education Act has had a similar history. No funds have been provided for construction and renovation under Title VII since 1973. In 1980, Congress did appropriate $25 million for Title VII, to assist colleges and universities in complying with Federal law requiring the removal of architectural barriers to the handicapped. These much-needed funds were later rescinded.

Congress needs to reaffirm its historic commitment to rebuild and replenish our academic and research facilities without which our research effort will not fully succeed. The labors of our researchers—however exceptionally talented they may be—will not bear fruit if their physical facilities and the tools of their work are inadequate.

Let me cite a few examples of the needs of Penn facilities which are indicative of a national need for Federal construction and renovation assistance for research and academic facilities.

ENGINEERING

The School of Engineering and Applied Science has experienced significant growth in both enrollment and the quality of its academic programs. A decade ago undergraduate and graduate enrollment in the School was 1043; today enrollment is 2076. In addition, over the past decade the number of undergraduate course units taught by engineering faculty to students from other schools of the University has more than doubled. The average SAT score for our entering freshman class is 1310, which places us among the top ten schools in the country. Entering graduate students are equally impressive. Externally sponsored research in the School stands at $95,700 per faculty member, which places us sixth nationally. It is important to note that this growth has occurred in response to regional and national imperatives, and that much of this growth has been in our strong interdisciplinary programs such as Computer and Cognitive Sciences, Bioengineering, and Management and Technology which link engineering with the other schools of the University. Most important, all of this activity and growth has occurred in facilities which have not changed in twenty years.

New and renovated research and teaching facilities are essential if we are to maintain the excellence of our academic programs. Despite housing graduate students in trailers, this year we have had to curtail enrollments, in the face of increasing demand, in order to maintain quality of education. Engineering facilities are desperately in need of repair, new equipment, and expansion. A proposed new facility, estimated at a cost of $15 million would provide laboratories for the Computer and Cognitive Sciences program and for bioengineering research.

CHEMISTRY

The research successes of Penn's Chemistry Department during the past decade, in the fields of laser chemistry, in the development of new superconducting materials, in assessing the structure and function of biological micromolecules, and in synthesizing new natural products with possible medicinal use, have been achieved in large part with the assistance of Federal research support. Among the by-products of these achievements is the need to renovate the Department's teaching and research laboratories, so that such essential research can continue and so that the Department can continue its leadership role in the integration of knowledge in the natural sciences, in engineering, and in medicine. It is estimated that this renovation will cost $3.5 million.

ANIMAL CARE

Penn's School of Medicine has undertaken a comprehensive study of its requirements for animal care facilities in the Division of Laboratory Animal Medicine. This study found a pressing need to upgrade the Division's animal care facilities necessary to support the growing research activities of the Medical School and the Hospital of the University of Pennsylvania. This will require construction at a new site, since the configuration of the Medical School and its physical relationship to the Hospital is incompatible with vertical or horizontal expansion of the current facility. Estimated cost—$19.7 million.

DENTAL MEDICINE

The existing building housing the School of Dental Medicine, built in 1915, is no longer compatible with the changing national educational and economic condition of dentistry. Rather than reducing class size haphazardly in response to nationally determined and manpower needs, the Dental School has designed a new and innovative curriculum to enable its student body to become smaller, but stronger. The curriculum will emphasize a collaborative approach to dental education, stressing research and primary care, and will provide for stronger preclinical training and early clinical experience, fostering a closer relationship between the teaching and practice of dentistry. A proposed new dental education building would house the educational, clinical, and administrative functions of the Dental School, and would serve as a keystone of a new health complex, blending the strengths of the Children's Hospital of Philadelphia, the Children's Seashore House, the Veterans' Administration Hospital, and a long-term care facility. The estimated cost of the new Dental School facility is $18 million. In the fiscal year 1984 Labor-HHS-Education

Appropriations bill, the Senate saw fit to provide $9 million, or 50 percent of the cost of the new facility, in its version of the bill, but this appropriation was not agreed to in conference. Penn continues to consider the new Dental School building, which will enable us to implement an innovative dental education curriculum of national influence, among its major Federal priorities.

N.I.E.

In response to your charge to consider the role of the National Institute of Education in our education enterprise, even as we strengthen and preserve the nation's research capacity, we need to pay more attention to the process of education itself. These next decades promise fundamental changes in how, when, where, and why students acquire skills. As a nation we need to understand better the link between work, learning, and productivity. We need a better sense of desired educational outcomes, particularly at the college level—what is practical as well as desirable. Attention must also be paid to issues which often lack glamour—how, for example, are families going to finance college educations and how are institutions going to replace their rapidly aging physical plants?

Here the National Institute of Education can play a principal role. It is important that the recompetition of NIE's centers and laboratories go forward, leading to broadened, more cogent research efforts focusing on the problems education will actually face in the future. It is also important that NIE continues to have sufficient funds to commission specific studies in critical areas of immediate importance. Here I am most aware of our University's NIE sponsored project examining how and why leading corporations invest in the training of their own employees. In a relatively short span of time, leading scholars working directly with major corporate executives and their training staffs, identified the key issues of practice and policy. The result is a new understanding of how workers can acquire new skills in a rapidly changing economy. This research is but one example of how a vigorous National Institute of Education can focus attention on real education problems and their potential solutions.

In conclusion, I would suggest that, if the Federal government is to be successful in nurturing, as it must, our research enterprise, it needs to: (1) sustain the recent positive action of Congress in funding scientific research, and translate that action into a trend of long-term real growth, in the humanities as well as in science and (2) develop a coordinated and well-funded program of general support throughout the range of Federal agencies for the construction, renovation, and rehabilitation of academic facilities, including research facilities and equipment.

As you consider the reauthorization of the higher education and other Federal statutes critical to the health of the research enterprise, we at Penn stand ready to help develop and respond to these initiatives.

Mr. MURPHY. Thank you, Dr. Hackney.

I failed to point out that any of you that have prepared statements, they will be submitted into the record totally, and if you want to talk around them or summarize it, that would be fine.

Dr. Edward Schatz of Carnegie-Mellon University.

STATEMENT OF EDWARD R. SCHATZ, SENIOR VICE PRESIDENT, CARNEGIE-MELLON UNIVERSITY

Mr. SCHATZ. Thank you very much, Mr. Chairman.

Carnegie-Mellon University is very happy to participate in such hearings.

At the outset, I would like to give you our president's apologies for not being here today. He would have liked to have testified himself. He actually is entertaining a group from the Department of Defense and several other Congressmen who are in town today looking at Pittsburgh as a possible site for a new software engineering institute. So you will have to do with me.

I would like to take a few minutes to talk a little about Carnegie-Mellon's research and to answer some of your questions you posed in your letter. Perhaps before I do that, I should associate myself

with all the preceding comments as well. They were all excellent and I think I need not go over many of those.

Carnegie-Mellon, a national research university, has a total research budget for the year ending 1983 of about $42 million. It's interesting to note that about 72 percent of that budget was funded by the Federal Government and about 28 percent was funded from other sources.

We're estimating next year—or the current year, that budget will go up to about $47 million.

It may be also of some interest to you that under the Federal amount, 43 percent of that budget is supported by the Department of Defense, and a good bit of that in research and computers.

I'd like to emphasize another matter about Carnegie-Mellon research, we have had a long history of cooperation between industry, starting with our founding institution, the Carnegie Institute of Technology and the Mellon Institute of Research. At the moment about 20 percent of our entire research budget is supported by industries in the Pittsburgh area and throughout the country. I think that is a rather unique situation for us and for a university of our size.

The percentage will increase in the coming years because of CMU's involvement with the University of Pittsburgh in the Commonwealth of Pennsylvania's Ben Franklin Partnership, as was mentioned earlier by Chancellor Posvar. This program is dedicated to economic renewal in the commonwealth through university-industrial cooperation.

I understand the subcommittee's wish to know about research on educational issues. Although Carnegie-Mellon does not have a College of Education, we have had certified teachers for a number of years, and we pioneered a number of years ago a new Doctor of Arts degree in education for teachers.

Our current research in education is supported by both the Federal Government and foundations and includes fundamental studies in cognitive psychology, research on organization processes, curriculum development in social history, and development of microcomputer-based logic programs in philosophy.

I think especially noteworthy is the work in cognitive psychology, which focuses on the processes of learning, and, thus, is very important to education both at the secondary and post secondary levels.

Carnegie-Mellon University is currently involved in an innovative and comprehensive educational development in the use of personal computers to enhance education at the college level.

With help from a number of computer manufacturers, most notably, IBM, a network capable of handling 8,000 to 10,000 personal computers is being designed.

It is anticipated that in several years every student and faculty member at CMU and many staff members will have a personal computer capable of significant computing power and of interconnection with the library and other data bases and with every other personal computer in the network.

The educational implications of this technological development are staggering; many are as yet undiscovered and certainly not predictable.

In order to take advantage of this development, the university has moved in two directions. Internally, a new Center for the Design of Educational Computing has been formed to fund and assist faculty members and staff in developing course material using educational computing and the new network.

The second direction is external; an interuniversity consortium for educational computing has been formed to foster development in other universities and to exchange information.

These efforts are currently being supported by the Sloan Foundation and the Carnegie Corp., but we had made a rather large proposal to the National Science Foundation for assistance.

The project which I have described is an educational research at the leading edge. There will certainly be implications for education at all levels and, therefore, becomes a matter of national concern.

The National Institute of Education should expand its research in education to higher education in areas like the one I have described as well as others.

Developments in educational computing are needed at postsecondary institutions of all types; they are vital and they may be expensive. A national effort will be needed.

Turning now to some other questions which you have asked in your letter. You asked about the role of the Federal Government in research activity. I think three, and probably more, areas can be identified easily—and some of them have been spoken about already.

The first area is the support of basic research in the natural and social sciences and in the mathematics and computer science. Much of the support at our university now comes from the Federal Government and it certainly should be continued.

The second area is the support of applied research in areas of special national needs; for example, robotics, computing, medicine, education, agriculture, the environment, and so forth.

The third area is the support of research for defense needs.

In all of these areas support by the Federal Government is needed for instrumentation and facilities—a matter already touched upon.

I'd like to just say a word about improving the existing research facilities with a little slightly different viewpoint than what has been covered already.

Much of modern research is carried on with expensive instrumentation and computers. Several Government agencies, notably the Departments of Defense and Energy and the National Institutes of Health, have good equipment grant programs.

These will probably have to be expanded and some further thought given to reducing the present heavy cost-sharing requirements; for example, cost-sharing from one-fourth to one-third is required on instrumentation. On expensive items—and items do become expensive—orders of hundreds of thousands of dollars, this adds up to a large contribution from the universities and a consequent limitation on research which can be performed.

Of equal, and perhaps, greater importance is the renovation of existing facilities. Most of our research facilities are old—and that has been covered by other speakers.

Modern science requires clean, well-ventilated rooms equipped with special utilities. The renovation of a single laboratory in biology or chemistry may cost as much as $200,000 or $300,000.

Carnegie-Mellon recently installed a class 100 clean room in an older building for research in solid-state electronics which cost all totaled $1.6 million.

"Bricks-and-mortar" money in the budgets for NIH, DOD and NSF would go a long way in upgrading the university research facilities of the Nation.

Lest we thought always of asking and not giving, I would just like to say that Carnegie-Mellon is well-aware and appreciative of the role of the Federal Government in the support of its research programs. And we also eagerly accept our responsibilities for cooperating with industry. Our research serves the Nation—as all of our research does—and we are thankful for that opportunity to serve. Thank you.

[Prepared statement of Edward R. Schatz follows:]

PREPARED STATEMENT OF EDWARD R. SCHATZ, SENIOR VICE PRESIDENT, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.

Carnegie-Mellon University is a private institution, classified as a national research university. Carnegie-Mellon consists of six degree-granting colleges, all of which have research programs in addition to their educational programs, and a research unit which carries out fundamental and applied research for government and industry. There are a number of interdisciplinary research institutes which concentrate on specific subject areas. Two examples are the Robotics Institute and the Magnetics Technology Center. The University has become increasingly recognized over the last decade for its programs in computer science. Before that time and continuing now, the University has been well known for its programs in engineering, science, management studies, the fine arts, and in humanities and social sciences.

Research in the University is supported by the Federal Government, the Commonwealth of Pennsylvania, a number of foundations, and by private industrial companies. Table I gives the distribution of research support from these sources to various CMU units for the fiscal year ending June 30, 1983. The total research support for CMU for that year, including indirect costs, was $43.45 million. Of this amount, 28 percent came from non-Federal sources and 72 percent from the Federal Government. Support from the Department of Defense accounted for 43 percent of the Federal total. Estimates for 1983-84 indicate that total research support will be $47.8 million.

An important point to emphasize about Table I is the amount of research conducted for private industry. Carnegie-Mellon has a long history of cooperation with industry in research through its founding institutions, Carnegie Institute of Technology and the Mellon Institute of Research. This traditional university-industry cooperation has continued and is now being expanded both in the colleges, institutes, and in the Mellon Institute. The percentage of industrially sponsored research, approximately 19 percent, is rather unique for a university of CMU's size. This percentage will increase in the coming years because of CMU's involvement with the University of Pittsburgh in the Commonwealth of Pennsylvania's Ben Franklin Partnership. This program is dedicated to economic renewal in the Commonwealth through university-industrial cooperation. It is estimated that in 1983-84 industrially sponsored research will increase to 25 percent of the University's total.

The sub-committees wish to know about research on educational issues. Although the University does not have a College of Education, teachers have been certified in a number of fields for several decades, and the University pioneered a new Doctor of Arts degree for teachers over 15 years ago. Our current research in education is supported by both the Federal Government and foundations and includes fundamental studies in cognitive psychology, research on organization processes, curriculum development in social history, and development of microcomputer-based logic programs in philosophy. Especially noteworthy is the work in cognitive psychology, which focuses on the processes of learning, and, thus, is very important to education at the primary, secondary and post-secondary levels. A sampling of the work going on is: cognitive processes in reading comprehension, instructing young children in

problem solving, development of children's understanding of physical phenomena and an information analysis of learning geometry.

Carnegie-Mellon University is currently involved in an innovative and comprehensive educational development in the use of personal computers to enhance education at the college level. With help from a number of computer manufacturers, most notably, IBM, a network capable of handling 8,000 to 10,000 personal computers is being designed. It is anticipated that in several years every student and faculty member at CMU and many staff members will have a personal computer capable of significant computing power and of interconnection with the library and other data bases and with every other personal computer in the network. The educational implications of this technological development are staggering; many are as yet undiscovered and are not predictable. In order to take advantage of this development, the University has moved in two directions. Internally, a new Center for the Design of Educational Computing has been formed to fund and assist faculty members and staff in developing course material using educational computing and the new network. The second direction is external; an inter-university consortium for educational computing has been formed to foster development in other universities and to exchange information. The Inter-university Consortium on Educational Computing (ICEC) consists of the following schools: Brown University; California State University, Northridge; City University of New York; Columbia University; Cornell University; Dartmouth College; Iona College; Mills College; Rensselaer Polytechnic Institute; Southwestern College; Stanford University; University of California, Berkeley; University of Wisconsin, Madison; and Vassar College. These efforts are currently being supported by the Sloan Foundation and the Carnegie Coporation. A large proposal for assistance has been submitted to the National Science Foundation.

The project which I am describing here is educational research at the leading edge. There will certainly be implications for education at all levels and, therefore, it becomes a matter of national concern. The National Institute of Education should expand its research in education to higher education in areas like the one I am describing as well as others. Developments in educational computing are needed at postsecondary institutions of all types; they are vital but they may be expensive. A national effort will be needed.

At the research level as Table I shows Carnegie-Mellon has significant research programs in a wide variety of areas. The areas of engineering and science have been traditionally strong but research is building in all areas. Computer Science has had phenomenal growth in the last decade and move recently robotics research has expanded significantly. I turn now to the University's views concerning support of that research.

The Federal government has a quite important role to play in the research activities of universities. At least three areas are easily identified: (1) Support of basic research in the natural and social sciences and in mathematics and computer science. Much of this support now comes from the Federal government and it should be continued. (2) Support of applied research in areas of special needs, i.e. robotics, computing, medicine, education, agriculture, the environment, etc. (3) Support of research for defense needs.

In all of these areas, support by the Federal government is needed for instrumentation and facilities.

In general the peer review system which determines meritorious projects has been used in the distribution of Federal Funds in the areas named above. This system has served the nation well and its continued use is recommended.

The need for impoving existing research facilities deserves special mention. Modern research equipment and renovation of research laboratories are presently vital national needs.

Much of modern research is carried on with expensive instrumentation and computers. Several government agencies, notably the Departments of Defense and Energy and the National Institutes of Health have very good equipment grant programs. These will probably have to be expanded and some further thought given to reducing the present heavy cost-sharing requirements. Presently cost-sharing of one-fourth up to one-third is required. On expensive items this adds up to large contributions from the universities and a consequent limitation on research which can be performed.

Of equal, and perhaps, greater importance is the renovation of existing facilities. Modern science requires clean, well-ventilated, rooms equipped with special utilities. The renovations of a single laboratory in biology or chemistry may cost as much as $200,000 or $300,000. Carnegie-Mellon University recently installed a class 100 clean room in an older building for research in solid-state electronics which cost $1.6 mil-

lion. "Bricks and mortar" money in the budgets for NIH, DOD, and NSF would go a long way in upgrading the university research facilities of the nation.

Carnegie-Mellon University is well-aware and appreciative of the role of the Federal government in the support of its research programs. We also eagerly accept our responsibilities for cooperating with industry and hope to expand these efforts. Our research serves the nation and we are thankful for the opportunity to serve.

TABLE I.—DISTRIBUTION OF RESEARCH SUPPORT AT CARNEGIE-MELLON UNIVERSITY JULY 1, 1982–JUNE 30, 1983

[In millions of dollars]

	Direct cost	Indirect cost	Total
Carnegie Institute of Technology (College of Engineering)	6.97	2.49	9.46
Mellon College of Science	12.66	4.02	16.68
College of Fine Arts	.16	.05	.21
Humanities and Social Sciences	1.62	.54	2.16
Graduate School of Industrial Administration	.68	.29	.97
School of Urban and Public Affairs	.75	.32	1.07
Mellon Institute of Research	5.05	1.88	6.93
Robotics Institute	3.64	1.14	4.78
Other	.91	.28	1.19
Total	32.44	11.01	43.45
Non-Federal Research:			
Industrial	5.76	2.22	7.98
Associations	1.89	.79	2.68
Foundations	.74	.07	.81
State Governments	.16	.03	.19
Miscellaneous Non-Federal	.45	.10	.55
Total non-Federal	9.00	3.21	12.21
Federal:			
Department of Defense	10.16	3.33	13.49
Department of Energy	3.20	.76	3.96
Health and Human Services	3.24	1.23	4.47
National Science Federation	5.41	1.91	7.32
National Aeronautics and Space Administration	.37	.13	.50
Miscellaneous Federal Government	1.06	.44	1.50
Total Federal	23.44	7.80	31.24
Department of Defense:			
Army	.95	.29	1.24
Navy	2.56	.97	3.53
Air Force	1.34	.57	1.91
DARPA	5.31	1.50	6.81
Total	10.16	3.33	13.49

Mr. MURPHY. Thank you very much, Dr. Schatz. Ms. Brownstein.

STATEMENT OF BARBARA BROWNSTEIN, VICE PRESIDENT, ACADEMIC AFFAIRS, TEMPLE UNIVERSITY

Ms. BROWNSTEIN. Thank you very much.

I would like to address particularly relationships of our institute of higher education to the Department of Education and to the National Institute of Education.

But first, as I represent what is probably the newest kid on Pennsylvania's research block, Temple University, I ought to say a few words about the institution.

Temple University is part of the Commonwealth's system of higher education, it's the largest university in eastern Pennsylvania and one of two senior comprehensive research institutions in the eastern third of the State.

This year we received approximately $54 million in external funding for research and graduate training; 65 percent of this came from the Federal Government; 85 percent of our research and training funds in the health-related fields came from the Federal Government.

So as you can see, the Government plays a major role in development of research at Temple University. Without this support, we could not carry out the recent significant programs we have in basic biomedical research and clinical research, in experimental physics, biology and chemistry and the very large programs in urban studies, developmental psychology, cognition and learning theory.

Some of the work that we have been doing using Federal funds includes work on the about-to-be-tested artificial heart; an attempt to change—well, to allow the recipients of these artificial hearts to carry around their paraphernalia in a briefcase instead of in a shopping cart.

There has been significant work on the development of liquid crystals, drugs that retard aging as well as a new generation of anticancer drugs.

We have large programs in the biological control of the gypsy moth on circadium rythms, effects of space on humans in space.

All of these projects began with government money; and, in fact, without the Department of Defense equipment money—which has been mentioned by several of the speakers—I don't think we would have a functioning department of chemistry today.

The research of equipment which had been purchased via the DOD funds also served to train undergraduate and graduate students. All this research that I mentioned a moment ago began with government sponsorship.

In each of the cases that I mentioned, we now have private sector support for futher development and implementation of these projects. And I think this is an important new development in our university and in most of the major research universities.

The Department of Education has provided support to Temple University primarily for training and service delivery programs.

Most of our basic research money has come from NIH and the Department of Energy and Department of Defense. However, the funds from the Department of Education have played a very important role in our institution; the funding of a pilot program in cooperative education has allowed the development of an academically-based-work-experience program for our undergraduates. This has been an extremely important program for us at Temple. Eighty percent of the undergraduates attending this urban university work in order to support themselves.

I should note that employment for these highly motivated, often very bright students, adds up to 20 to 40 hours a week, and these students were working in fast-food restaurants, driving cabs, tending bar.

The Department of Education funds have allowed job development and training so that students are now placed in jobs related to their future careers, jobs in which they learn and jobs in which they are supervised by Temple faculty.

I can't speak too strongly about the success of this program. We are now in the second year of a 3-year grant and cooperative education. I cannot speak too strongly about the importance of financial aid from the Federal Government. The loans and grants make higher education possible for our students.

These students are often the first in their family to attend a university and are completely dependent upon financial aid.

Any cut in Federal funds for student aid has a disasterous effect on us, and transfer of these funds from the Federal to the State control have not been beneficial to us and to our students.

This year we're spending 11 cents of every tuition dollar on financial aid, so that those few students who do pay fully are supporting out of our limited hard money financial aid for our very needy students.

Other programs supported by the Department of Education funds have been essential to the mission of our American universities; these are the Teacher Corps funds, funds for the bilingual training program, the business and international education programs and the law school training programs.

While we have received very little in the way of Federal support from the Department of Education for international education, we are committed, as are our colleagues, to improving and expanding this activity.

As Chancellor Posvar mentioned, we also have about a hundred mainland Chinese scholars on our campus studying, and we have a dozen students and a half a dozen faculty members in China now working for periods of time at the Chinese universities.

We have opened a campus in Tokyo, where we now have 450 Japanese students studying at Temple University in Japan, with many Temple graduate students and faculty making their base in Japan.

We have developed a critical language program and computer-assisted learning program with which we now teach 60 languages, including those that we were never able to teach in the usual one-on-one kind of teaching—Thai, Japanese, Swahili, and many others.

All of these programs, each of which has some support from the Department of Education, are very important elements of training in education at our institution.

I want to mention one other which my colleagues haven't mentioned and haven't been involved in; that is the biomedical training program, which is one of the most exciting experiments in cooperation between a major university and inner-city public schools. Four years ago, the Department of Education provided initial funding for what was to be a 4-year model program to bring disadvantaged high school students and their science and math teachers onto university campuses for training.

The purpose was to start ninth grade students on a path toward careers in the biomedical field, to upgrade the skills of their high school teachers, and to prepare these students for college.

The Department of Education predicted that we would have 25 percent retention rate; we are now in the fourth year, and 61 per-

cent of the entering students are seniors and every one of them has been accepted for college the next year.

For the past 3 years, Temple University received $240,000 a year through the Department of Education for this highly successful program. This year the funding was cut to zero. The effects have been devastating.

It has hurt the direct services to students; it will stop this upgrading of teachers' skills, which have been carried back into the high schools to teach a larger group of students; and it has disheartened the parents of these students, who have been very involved in this joint university-public-school project.

Four years ago these students were asked to make a 4-year commitment to the program, and they have. They have spent every Saturday during the winters and 6 weeks in the summer on our campus; they're dedicated; they're excited; they're enthusiastic; they have worked not only with their own teachers, they have worked with university faculty and scientists, with doctors, with nurses, physical therapists.

While Congress has approved funds for this program—there are 12 of them across the country—Secretary of Education Bell has decided not to spend any of his discretionary funds on these programs.

We have been forced to seek substitute funds. We just received $62,000 from a local foundation and, again, we're using some of our own money, and drips and drabs, volunteered to keep this program afloat and, at least, to get this first group of 150 high school students through their final year.

As I said, only a very small portion of Federal funds awarded to Temple are in support of research in education. Compared to the dollars that have been available from the various agencies of the Department of Health and Human Services, funding from the National Institute of Education has been trivial.

The already small pool of funds of NIE has been reduced even further over the past 5 years. And compared to the support for other research, the complex field of education has been grossly neglected.

The funds available for extramural educational research are so limited that most of our seniors and serious investigators no longer want to devote the time to be preparing competitive applications.

We are prepared to do research on educational systems, on cognition, on developmental disabilities, on the learning of language; in fact, we are doing it.

There are very successful models that we could use to get support. Every research university that has a college of education may apply for dean's grants in special education from the Department of Education.

I would like to propose the creation of a university-administered grant, president's grant, provost grants, which would allow the institution to bring together scholars from across the university to work on problems facing teachers, teach education, and learning systems today.

We could address a number of issues: The implementing research in education; how to get what we already know to where it can be used; the integration of new technology in teaching and learning.

We could address the questions of excellence and equity; how to maintain standards and qualities while encouraging underprepared students; and, we're prepared to do basic research on the learning process, on bringing together physiology, psychology, pedagogy in an effort to understand how we learn and how we should teach.

The creation of such special grants could be a model for university contributions to the improvement of our elementary and secondary schools, as well as the advancement of the university.

Another area of research that I will mention only briefly that is legitimately supported by the Department of Education is the study of developmental disabilities and tools for the handicapped.

Temple runs a major residential center for the developmentally disabled and a major research and training program. While we're gratified that this is one of the areas which has been identified by Congress for increased support this year, it is still grossly underfunded considering the need.

And finally, let me touch on two major problems that my colleagues have already addressed that all universities are encountering. We must be able to develop and maintain a library system that's appropriate for research and training. Every university has fallen behind. The cost of journals has escalated beyond any expectation.

The need for automation, the need for retrieval of information electronically is enormous and we simply can't keep up. And, of course, we must be able to provide adequate equipment and instrumentation for our students and researchers at all levels.

The basic instructional and research equipment that has already been mentioned both from the podium and from the panel is—we're at a state of disaster.

The basic equipment that we need to replace obsolete and unrepairable equipment and to bring us in Temple to state-of-the-art status in engineering, science, and arts requires upward of $30 million as a one-time expenditure, with at least $2 million a year to maintain that status.

I don't know how we're going to get this money. I understand Representative Simon's reluctance to try and put an item this large into the Department of Education or in the Higher Education Act, but I think that perhaps we're going to have to have some kind of a national authority to do this.

We have had these programs for bricks and mortar in the past, now we need something—we need an authority to supply universities and colleges with the equipment and instrumentation that will allow us to utilize the bricks and mortar that public funds have already put in place.

Buildings without the means to carry out research at the forefront of knowledge are becoming useless.

The participation of the Federal Government in sponsored research and education is certainly legitimate. While particular regions have particular needs, we, as a school facing the inner city have particular needs. The need for educational research is certainly national and should be a national priority. Thank you.

[Prepared statement of Barbara L. Brownstein follows:]

PREPARED STATEMENT OF BARBARA L. BROWNSTEIN, VICE PRESIDENT, ACADEMIC AFFAIRS, TEMPLE UNIVERSITY

Temple University of the Commonwealth System of Higher Education is the largest senior comprehensive research institution in Eastern Pennsylvania. In 1982-83 the institution received approximately $54 million from external sources for research and training. Federal funds accounted for 45 percent of all sponsored programs excluding those in medicine and health sciences. If we exclude financial aid and the developmental disabilities center (a major state-supported treatment facility), that percentage climbs to 65 percent. At our Health Sciences Campus, the money for research and training programs funded by the Federal Government make up 85 percent of all sponsored programs.

The Federal Government plays a major role in the funding of all types of research at Temple University. Without this federal research support, Temple University could not carry out its significant programs in basic biomedical research, clinical research, experimental physics, molecular biology, chemistry, urban studies, cognition, developmental psychology, and learning theory, among others. Examples of our work include research on a soon-to-be-tested artificial heart, biological control of the gypsy moth, a drug that retards aging, as well as a new generation of anticancer drugs. In the area of social and human services research, our Institute for Survey Research investigates drug abuse, environmental causes of disease, and age-specific fertility rates to predict birth rates. In the physical sciences, our geologists are currently engaged in work on hazardous wastes.

The Department of Education has provided support for a number of training and service delivery programs at Temple. The funding of a pilot program in Cooperative Education allowed development of an academically-based work-experience program for undergraduates attending this large urban university. This has been an important program at Temple, an institution in which 80 percent of the undergraduates work while attending school. I should note that employment for these highly-motivated, bright students often adds up to 20 to 40 hours a week of working in fast food restaurants, driving cabs, tending bar. The Department of Education funds have allowed job development so that students are placed in jobs related to their future careers, jobs in which they are supervised by Temple faculty.

We cannot speak too strongly about the importance of the federal financial aid programs. The loans and grants make higher education possible for our students, often the first in their family to attend a university. Any cut in these funds or the transfer from federal control to the state creates enormous and special problems for metropolitan institutions.

Other programs supported by Department of Education funds that are essential to the mission of our urban university are the Teacher Corps, the Bilingual Training Program, the Business and International Education Programs and the Law School Training Programs. These constitute important elements of training in education at our institution.

Of particular interest at the moment are several programs that have, in the past, been supported by the Department of Education and which are now threatened with extinction. The GPOP (Graduate Professional Opportunities Program) is designed to support the graduate studies of minority students and women in fields in which they are underrepresented. This program has permitted the doctoral training of students in psychology, biology and a number of pre-clinical sciences.

The Biomedical Training Program was one of the most exciting experiments in cooperation between a major university and inner-city public schools. Four years ago, the Department of Education provided initial funding for what was to be a four-year model program to bring disadvantaged high school students and their science and math teachers into universities. The purpose was to start 9th grade students on a path towards careers in the biomedical field, to upgrade the skills of their high school teacher, and to prepare these students for college. The Department of Education had predicted a 25 percent retention rate; in the Temple University Program 61 percent of the entering students are now seniors and all are expected to enter college next year. For the past three years, Temple University received about $240,000 per year; this year, the funding was cut to zero.

The effects have been devastating. It has hurt the direct services to the students; it has virtually eliminated the benefits to the teachers who learned how to teach these disadvantaged students; it will lessen the upgrading of teacher skills which have been carried back into the school system to a larger group of students; it has disheartened the parents of these students who had been actively learning how to help their children learn through an involved, supportive parents association; and finally it violated the trust developed by the students in the system. Four years ago

these students were asked to make a four-year commitment to this program and they have. They have spent their Saturdays, their summers at the university giving up other extracurricular activities. They are dedicated, excited, and enthusiastic. They worked hard at basic skill development and learned first-hand from scientists, doctors and nurses.

While Congress has approved funds for these 12 bio-med programs around the country for the fourth year, Secretary of Education T. H. Bell has decided not to spend any of his discretionary funds for these programs. Temple University has been forced to seek substitute funding from other sources; $62,000 was donated by a local foundation to maintain a skeleton staff for the coming year, and we must cancel the valuable summer portion of the program.

Only a very small portion of federal funds awarded to Temple are in support of research in education—theories of learning the physiology and psychology of cognition, the development of teaching systems. Compared to the dollars that have been available from various agencies of the Department of Health and Human Services, funding from National Institute of Education has been trivial. The already small pool of funds for NIE has been reduced even further over the past five years. Compared to support for other research, the complex field of education has been grossly neglected. The funds available for extramural educational research are so limited that serious investigators no longer want to devote the time to preparing competitive applications.

We are prepared to do research on educational systems, cognition, developmental disabilities and the learning of language. The participation of the federal government in sponsored research in education is legitimate. It addresses a national need and should be a national responsibility.

Every research university that has a college of education may apply for Dean's Grants in Special Education from the Department of Education. We propose the creation of a university-administered grant (President's or Provost's grant) which would permit the institution to bring together scholars from across the University to work on problems facing teachers today. For example, here are four areas that might be addressed by such cross-disciplinary programs: (1) Implementing research in education—how to get what we already know into use in the classroom; (2) The integration of new technology in teaching and learning; (3) Excellence and equity—how to maintain standards and quality while encouraging underprepared students; (4) Basic research on the learning process: the fusion of physiology, psychology, pedagogy. Creation of such special grants could be a model for university contributions to the improvement of our elementary and secondary schools.

Another area of research that is legitimately supported by the Department of Education is the study of developmental disabilities. Temple University runs a major residential center for the developmentally disabled and a major research and training program. While we are gratified that this is one area which has been identified for increased support, it is still greatly underfunded considering the need.

And finally, two other major problems we in the university community have encountered are concerned with the maintenance of library systems appropriate to the research and training functions and the provision of adequate equipment and instrumentation for our students and researchers at all levels. The basic instructional and research equipment needed to replace obsolete and unrepairable equipment and to bring us to "state-of-the-art" status in engineering, science and arts requires upwards of $30 million as a one-time expenditure with $2 million per year to maintain that status. I would like to propose the addition of a companion authority to supply universities and colleges at all levels of instruction with the equipment and instrumentation to better utilize the bricks and mortar that public funds have already put in place. Buildings without the means to carry on research at the forefront of knowledge represent a system failure that this law could remedy.

Other elements of the research system include upgrading the educational training of critical faculty at all levels, but especially to support engineering and computer science. Pending legislation passed by the House, H.R. 1310, would do much to remedy this and other serious omissions. Perhaps if we take one element at a time and work together, we may fashion a better national system.

Mr. MURPHY. Thank you very much, Ms. Brownstein.

Provost Roger Benjamin from the University of Pittsburgh.

STATEMENT OF ROGER BENJAMIN, PROVOST, UNIVERSITY OF PITTSBURGH

Mr. BENJAMIN. Thank you, Chairman Murphy and Mr. Simon.

My written remarks refer especially to graduate education and research. Many of those have been touched on, not only by the colleagues here, but by Chairman Murphy.

I think what I wish to do is frame my remarks really in response to——

Mr. MURPHY. Excuse me, Mr. Benjamin. We don't have a copy of your written statement.

Mr. BENJAMIN. We will be providing that soon.

I wish simply to respond a little bit by framing my discussion this morning as sort of a response to the challenge of Mr. Simon for a little bit more vision. I don't know if I can rise to the occasion or not.

I also wish to say that I have only been in Pittsburgh for 2 months, but I assure you the need for the Higher Education Act is felt in Minnesota as highly as it is in Pennsylvania.

The year 2,000 is not very far away, and by that time we, in the United States, will represent less than 2 percent of the world's population, and an aging population at that. And it's commonplace, but it is true that we're really going to have to begin upon our brains and not our brawn if we're going to survive in a very competitive world.

I think it is symbolic that we're this morning talking about these issues in Pittsburgh, which is in the throes of a very painful but a very successful restructuring of its economy. This is the place, as you know, that really started the industrial revolution in this country, one of the focal points, and now we're attempting to desperately and energetically move into a post-industrial society.

Now, it's also the case, I think, that here in Pittsburgh and in Pennsylvania, and indeed the Nation, we're in a period in which the intellectual cupboard is somewhat bare.

Chancellor Posvar has well cited a need for international education, the basic research needs have been noted here, but primarily it's a period in which we're unsure. We're fairly clear that we're in a period of professional societal change, but we don't know where a lot of these courses are going to be taking us.

I'm talking about the industrial problems of the country; one talks about the plight of sovereignty these days, interdependence is not a cliche and so on, all of these things have been touched on this morning.

Let me make my points very swiftly then. First, I do think the direction for a decentralized university system in this country is still very, very small.

Here I just want to try to move this argument a little bit out of the political arena. The American system focuses accountability at the local and State level, and it promotes and offers a variety of choice for our students, and I think most importantly it promotes competition for research dollars, for faculty and the competition among universities, and I think it is really the best system of education in the world still. But I do think for all of that there really is a compelling argument for Federal financing in higher education, especially in research graduate universities, a component.

And most of those arguments have already been cited. First of all, universities in the research and education dimension are a natural resource, and we have heard a lot about that this morning.

More importantly or equally important, I think the research needs are moving beyond the States and, indeed, beyond the private endowment capacity of our privates to meet those needs, and unless something is done about it, our infrastructure will simply decline.

Now in my written remarks I note articular examples of needs in computer science, engineering science and mathematics, as my other colleagues have mentioned.

Our students, for example, at the University of Pittsburgh, have slept overnight to get in line for computer classes for the last couple of semisters. We do have a substantial problem of faculty recruitment in these areas.

The numbers of graduate researchers is turning around, as has been mentioned, but there is some substantial evidence that the quality of our graduate students really is not what it should be, and that's a very serious problem.

And, of course, the research library needs have been mentioned.

It's fashionable to talk these days about the concept change compared to advantage and the problems that that denotes in economics and what it really boils down to is what happens when steel gets produced more efficiently in Japan or Korea and so on, and I think it can be reasonably argued that higher education really in the United States has a real comparative advantage. It's at this end, as I mentioned, knowledge, production and consumption is really what we ought to concentrate on for security—national security, national interest, national needs.

And, indeed, this has been mentioned, these universities and research institutions in Japan and elsewhere are becoming very competitive, they really are.

Here is my attempt to respond to you, Mr. Simon. I think really there are only 40 or 50 research universities in the world that have the infrastructure to try to address the problems of planning. And I don't like to be defensive, and neither does any leader in the United States or the American society, it's not our nature to be defensive, and the thing that I'm worried about—and the thing that I wish to say is that most of those universities are in this country, here at the table, and around in other States, but only a handful in Europe and maybe one in Japan, that just have the capacity of the research libraries and the faculties, the critical mass to think about food and the development of security and, more importantly, all the economic issues that we know of, and I'm worried whether we're up to it, because if we're not up to it, I don't believe anybody is.

So I'd like to translate the national interest concept, really, into an international interest concept, because I don't think we can divorce the two anymore.

I just want to end on that note, because I really do think we have the capacity to take on these problems, if we put our minds to it. I just want to thank you very much for having this hearing this morning.

Mr. MURPHY. Thank you very much.

Mr. Simon.

Mr. SIMON. Yes. If I might just go down the line here asking questions.

Dr. Jordon you, in talking about your needs, you come up with kind of a minimum $17 million figure—I can't find it right now, but I think——

Mr. JORDAN. That's correct, sir.

Mr. SIMON. You were talking about $17 million to bring your facilities up to date.

Mr. JORDAN. It's a 5-year need, sir, of $17 million a year. That's correct, sir.

Mr. SIMON. Just by coincidence, the reauthorization of the Higher Education Act would be a 5-year reauthorization.

Now, when we're talking about your $17 million, to determine what the national need would be, how would we determine, how do we translate that $17 million into the 40 or 50 institutions that Dr. Benjamin was talking about?

Mr. JORDAN. The way this was done at Penn State was to simply take the basic book value of research and teaching equipment which needs replacement, and simply divide by the 5-year period. I would assume that those numbers could be assembled nationally and monitored, audited in some way to be sure that they're accurate, and then divide over the 5-year period.

Mr. SIMON. We're provided numbers very readily, but one of the things we have to do is we put in numbers into legislation and try to make them as concrete and as practical as possible and not some abstraction someone has pulled out.

You say that your institution represents, what, 1 percent of the needs of the Nation? Can we take your need and multiply it by 100?

Mr. JORDON. Well, most of those needs lie in those 50 universities which comprise the Association of American Universities, I think, and every university at this table, save one, is a member of that. Outside of that there may be another 10 or 15 universities, so if you look at those that really produce the vast amount of the important basic and applied research in this country, I would have to put my pencil and paper to it, but I would guess——

Mr. SIMON. So you're talking about 65, would you say?

Mr. JORDAN. I would guess. There will be those who would disagree with me and want to put another 20 or 30 in it.

Mr. SIMON. All right. But then we're talking about, using my very rough mathematics here, of building in $1.1 billion per year. Of that $1.1 billion, how much should the Higher Education Act assume and how much should be allocating to NIH, the Department of Agriculture, the Department of Defense, and so forth?

Mr. JORDAN. Well, in the Department of Agriculture—and we're the agricultural college for the State of Pennsylvania—much of the funding there is in the Cooperative Extension Service, and we have not talked about that in terms of our research equipment needs, that's a separate item.

Mr. SIMON. Separate from the $17 million?

Mr. JORDAN. When I talked about the $60 million we do a year in basic research. And I think the best way to approach that matter, I would guess, would be to assume that we're a fairly typical situation in that regard, fairly typical.

Mr. SIMON. I'm assuming that, and what I'm trying to do is get a hold of a figure that I can live with that is practical in terms of the Higher Education Act.

Mr. JORDAN. You're talking about spreading it around among different funding sources?

Mr. SIMON. That's right.

Mr. JORDAN. It appears to me that when you mentioned a while ago the National Science Foundation as a place to lodge facilities funding that that would be somewhat different from the philosophy that's been expressed in that agency; it would be at least in recent years a new approach to funding buildings.

The Higher Education Facilities Act of some years back was the vehicle that served us well in those days, and I would urge that that approach be looked to again.

Mr. SIMON. OK. I don't mean to be giving you a rough time here, but of that—let's just assume we're talking about a $1.1 billion figure we need each year for 5 years. Of that $1.1 billion, how much of that should we be assuming that ought to be part of the Department of Education through the Higher Education Act; what should you be assuming; what should other agencies be assuming?

Mr. JORDAN. That's a difficult question, Mr. Simon, for me to answer because I don't know where else it might be lodged in terms of Federal funding. I simply don't have a way to give you an answer to that.

Mr. SIMON. Any comments from any of the other witnesses on that?

Mr. HACKNEY. I'd be glad to go think about that and send you a suggestion.

Mr. SIMON. All right.

Mr. SCHATZ. Well, one thought that I might venture is that basic research in universities is supported by more than the National Science Foundation; talking about the Department of Defense, the Department of Energy. Perhaps some portion could be made to those agencies based on the amount of support they give universities.

I'm sure the Department of Defense has every good reason to want universities it has supported to be properly equipped and properly housed. And they do, incidentally, have such programs going now. Perhaps some sort of apportionment would be the way to do it.

It does seem rather difficult for the Higher Education Act to assume all this.

Mr. SIMON. We can't, but what we have to do is to assume—what we want to do is move ahead and help, we don't want to load our vehicle down so heavily that it sinks.

Mr. JORDAN. Mr. Simon, a suggestion from my colleague on the right reminds me that if one looks at the direct cost budget at Penn State, only the direct cost research budget, which is about $60 million, I think you can find within that a DOD portion of in the range of $15 or $16 million.

Now, Penn State may not be typical in that regard, but that begins to talk about proportion a little bit in terms of total dollars spent on a given basis.

Mr. SIMON. Then if I could refer to Dr. Schatz' testimony—do all of you have a copy of his testimony there?

He has a table 1, and I understand that everything on table 1, down at the bottom where you talk about Federal research, the one, ARPA, I have to say that's one acronym I can't——

Mr. SCHATZ. I'm sorry I used acronyms in my research. I'll spell it out. That's the Advanced Research Project Agency. It's part of the Department of Defense, and it supports us at about $5 million a year and a large portion of that, by the way, goes into our computer science.

Mr. SIMON. So then if I total your figures again, and again with my hasty math, of the $24.44, $10.16 comes from the Department of Defense?

Mr. SCHATZ. That is correct. I wish I had done that for you. It's 43 percent.

Mr. SIMON. 43 percent?

Mr. SCHATZ. 43 percent of our Federal dollars comes from the Department of Defense. I think again that's high.

Ms. BROWNSTEIN. It's very high.

Mr. SIMON. As the rest of you look at those figures, are they not typical of your institutions?

Mr. HACKNEY. I think we all might vary a little bit. We're very—Penn is very heavily dependent upon NIH, two-thirds of our funds come from NIH, and the other is spread among NSF, Defense, Energy—lots of Energy.

Mr. SIMON. Ms. Brownstein.

Ms. BROWNSTEIN. Yes. I think at Temple that the largest percentage of our funds comes from Health and Human Services, one of the agencies there with an increasing proportion from the Department of Defense over the past 4 or 5 years, but nothing like 43 percent; perhaps 10 percent of the funds, and also, the Department of Energy funds have been increasing over the years; Department of Education funds have been level or declining.

Mr. SIMON. Dr. Jordan.

Mr. JORDAN. Yes. Mr. Simon, my colleague just brought a piece of paper to me that I think can be somewhat helpful in the way Penn State distributes these dollars.

If one looks at a total research flow of about $88 million at Penn State, including the Cooperative Extension Service—we can't break that out just here—we find from Agriculture about $17 million, from Commerce about a quarter of a million, from Defense—that's a little low—about $18½ million, Education about $20 million, and that would include matters other than research, of course, Energy about $3 million, Health and Human Services about $16 million, Interior $1½ million, EPA $500,000, NASA $2.2 million, National Science Foundation about $6 million, other about $2 million.

Mr. SIMON. So at your institution about roughly 18 percent comes from the Department of Education?

Mr. JORDAN. That would seem to be correct.

Mr. SIMON. Would that be——yes?

Mr. HACKNEY. I was going to give you a similar figure. At Penn, out of $102 million total Federal dollars for research, $8,800,000 comes from Education, roughly 8 percent.

Ms. BROWNSTEIN. It depends also if we have financial aid, this is without financial aid.

Mr. JORDAN. That's the thing that's not broken out here either, Mr. Simon.

Ms. BROWNSTEIN. I would think your 18 percent may include some financial aid from——

Mr. JORDAN. Your figure would include financial aid, I believe.

Mr. SIMON. OK.

What, if I may ask you and the president of the University of Pennsylvania, NIH are refining, they're maintaining their programs with you, are they declining or——

Mr. HACKNEY. They have been declining for the last 10 years in real dollars rather dramatically by 50 percent. In the current year, we expect them to edge up again. We're optimistic in that regard. It has also gotten to be much more competitive; that is, there are more researchers out there looking for these declining real dollars.

Mr. SIMON. Ms. Brownstein—incidentally, Mr. Hackney, Richard Weinberg of your faculty has contributed immensely to this whole form——

Mr. HACKNEY. In the language and——

Mr. SIMON. That's exactly right. And many of us are grateful to him and to your institution for that.

Mr. HACKNEY. Thank you very much, we're proud of him.

Mr. SIMON. And Ms. Brownstein, while I'm mentioning individuals by name, I mention Dr. Franklin Latelle, who heads a small institute for the study of the holocaust, I am one of these people, my name is on the list for being on the board and I regret to say that over the years I have done very little.

Ms. BROWNSTEIN. Well, I hope you will come and visit it and the institute.

Mr. SIMON. I really should do that. I think it is extremely important that we—that everyone, all of us be reminded from time to time that humanity can go off the deep end and do some terrible things, and your institution is helping in moving us in the right direction.

I am pleased with your testimony of the biomedical program. These dozen small programs have really been—they have indicated what the potential is if we're willing to spend a few dollars and to really reach for that brain power that is there.

You talk on page 5 of your testimony about: we propose the creation of a university-administered grant, president's or provost's grant, which would permit the institution to bring together scholars from across the university to work on problems facing teachers today.

We are talking in terms of summer institutes and that sort of thing.

Are you talking here in—well, maybe you can explain that.

Ms. BROWNSTEIN. I'm talking more in terms of research on teaching and learning. We have been addressing here our basic research in the biomedical fields in basic chemistry and biology.

I think we have the potential for doing this, all of us have the potential for doing this basic research on the process of learning and on the transmission of information. I was suggesting that we bring together, not only our faculty in colleges of education, the

faculties in physiology, psychology, teaching methods to use now what we now know, as well as, new information that has been accumulated in these discrete fields, and fusing these together into and developing applications and implementation now in the process of learning and in the process of teaching.

I was suggesting that a very legitimate role for the National Institute of Education is to foster this kind of cross-disciplinary research and development of educational theory, educational understanding.

Mr. SIMON. OK. I might mention, we had a task force on American pay, which I chair that pull together private citizens and four Members of the Congress, and one of their recommendations was along this very line.

What would you suggest, that NIE be the instrumentation for this?

Ms. BROWNSTEIN. I think this would be comparable to some of the kinds of cross-disciplinary programs supported by NSF and NIH in other areas. We are now pulling together people that study in the psychology of reading with pathology of reading, dyslexia, and other areas, and they keep coming to our medical school from our basic biology departments, from the psychology departments as well as the College of Education, and I was suggesting that this is an approach that NIE might want to use in support of research on education and higher education.

Mr. SIMON. And what kind of dollars would we be talking about just in your school to do this?

Ms. BROWNSTEIN. Well, I haven't put a dollar figure on this as yet. The dean's grants in special education at our school runs about a quarter of a million a year, perhaps a little bit more. This would certainly allow us to do a—a quarter of a million to half a million dollars a year would allow us to do a pilot developmental studies in this area.

Mr. SIMON. I thank you all very, very much for your participation. Thank you, Mr. Chairman.

Mr. MURPHY. Thank you, Mr. Simon.

I have one question that I'm interested in. Dr. Schatz mentioned, he has approximately 20 percent of his research money coming in from private industry, and I take it that your other universities do not have it that high. Is that right, Dr. Jordan?

Mr. JORDAN. The percentage at Penn State is about 14½ percent and rising. It's risen in the last 3 years from about 10 to 14½.

Mr. MURPHY. Are you making a serious effort to increase that amount?

Mr. JORDAN. As a matter of fact, we just established a new office with a 10-person staff to deal specifically with relationships between university and private industry in terms of research and such activities.

Mr. HACKNEY. The University of Pennsylvania is also looking quite aggressively now for support from the private sector, from corporations and industry in various ways. We have not yet reached to a 10-person staff, but we're looking at that sort of thing.

I think nationally the figure is about 4 percent, 4 percent of the university-based research effort is sponsored by——

Mr. MURPHY. Four?

Mr. HACKNEY. Yes, 4. So Carnegie-Mellon is very high.

Mr. MURPHY. Would you say that's true, Mr. Schatz?

Mr. SCHATZ. I would agree with that, yes, it is. And we haven't been doing that very aggressively. As I mentioned in my talk, I expect our number to go up, and I would expect the University of Pittsburgh's number to go up because of the Ben Franklin Partnership, which does suggest—or does require industry-university cooperation in renewing the economics of Pennsylvania.

Mr. MURPHY. Is Temple taking advantage of that?

Ms. BROWNSTEIN. Yes. We're part of the Ben Franklin Partnership.

Mr. HACKNEY. In the eastern part of the State we do it also.

Ms. BROWNSTEIN. We have a consortium in southeastern Pennsylvania made up of Penn, Temple, Drexel and a number of medical schools and institutions, and this has been an interest certainly, to us.

Mr. MURPHY. Ms. Brownstein, the 240,000 you have for the biomedical program, the source was the Department of Education under the discretionary fund, I guess. When was that——

Ms. BROWNSTEIN. That lasted up to July 1 of this year.

Mr. MURPHY. July 1 of this year.

Ms. BROWNSTEIN. It's a very inexpensive program, $1,000 per student.

Mr. MURPHY. What efforts, if any, have you made with the Department of Education to allow that funding to continue?

Ms. BROWNSTEIN. We have made our own extensive lobbying efforts along with parents and others, both Senators from Pennsylvania and all of our regional Congressmen have been very active in lobbying for us. It has been, so far, to no avail.

Mr. MURPHY. Do you have a current application in to reinstitute the program?

Ms. BROWNSTEIN. Oh, yes.

Mr. MURPHY. Are you continuing the program, less the $240,000?

Ms. BROWNSTEIN. We are continuing the students who are in the course. We do not feel that we could, in any good faith, admit a new class of ninth graders this year. So that we are going to find the money with a little bit of help from our friends and get the students who are currently enrolled through.

Mr. MURPHY. It seems to me you're getting to the core of one of the basic problems in pointing out the crisis medication in getting the instructor at the high school level back into this.

Ms. BROWNSTEIN. I might mention that President Hackney has taken the lead in establishing in Philadelphia a group of corporate executives to help establish links between the public schools and higher education. One of the models, obviously, that we're using in attempting to get this private support is this biomedical teaching model, whereby, we're not only training the students, but we get the feedback by training the high school instructors as well, so when they go back they have a much greater effect on the 150 students.

Mr. MURPHY. I want to thank you very much. We could go on, Paul and I, I'm sure for another hour, but we will be back. We have the NIE that we want to hear from this morning, so we will say thank you again.

Mr. SIMON. This is away from the assigned topic here today, but one of the concerns that I had is the increasing economic segregation of American higher education.

It was illustrated on the front page of the New York Times when Wesleyan said they were going to have to take a smaller percentage of the poor students. Most universities aren't that candid at least on the front page of the New York Times. But the trend is very clear.

Part of what is causing that is the increase in tuitions. My daughter is a student at Georgetown Law School, $8,400 tuition. How can you afford that if you're a family of very limited means? Is there any way the Federal Government can encourage schools like yours to slow down on tuition increases?

One of the difficulties that I find is that our student assistance programs, in fact, seem to do the opposite; the more you charge, the more we provide in assistance to the students, so the incentive is to up that tuition and we end up, for a variety of reasons, squeezing out students from many institutions.

That's a very general question, but what can we do to keep your five institutions so that you can get that tuition down?

Mr. HACKNEY. I'd love to speak to that for hours.

Mr. SIMON. Yes. We'll decline to hear that, I'm sorry.

Mr. HACKNEY. I'll try to limit myself to 2 minutes.

This is a problem that is very serious and in we have been facing it. In fact, we have just put together a new loan program that is going to attempt to answer some of the needs.

Let me argue a bit with your premise there. For a high cost-high quality institution such as Penn, the tuition never has paid the full cost of the education, and for our students, even from the neediest students, the Federal support, which is absolutely crucial, does not cover the total cost of tuition, room and board and those things.

So we don't need any additional incentive to keep tuition down; not only do we have a real economic incentive to limit our costs, but we have our own political pressures on the campus from the students and from their parents, and our trustees are very sensitive to that.

We do need help though, both through the established programs and, if I could put in, one of the things that is quite threatening at the moment is the possible tapping of tax-exempt bond issues for the purposes of student loans. If that were to happen, we would have almost no other place to turn for the kind of loan funds that our middle-income students and students with economic needs must have in the future if they're going to be able to come to Penn.

Mr. JORDAN. Mr. Simon, Penn State over the past 10 years, tuition costs have risen 170 percent, and that is keyed pretty much to the amount of our total operating budget, which comes from the Commonwealth of Pennsylvania.

Twelve years ago, the Commonwealth supplied 40 percent of the university's operating budget; today they supply about 25 percent. As that figure has come down—that is, the State appropriation as a percent of total operating budget, tuition has gone up.

For the first time in 10 years, Penn State is attempting to freeze its tuition level at last year's level, and the board has approved a projected operating budget that does that. That will depend finally

on our success and on the ability of the Commonwealth to provide a bit more of the operating budget than it has been doing in the past.

Mr. SCHATZ. Carnegie-Mellon is also a high tuition institution; 65 percent of our undergraduates now receive financial aid in some quantity; financial aid supplied partly by the Federal Government and certainly by a lot of our endowment. We do hope to keep access to our institution open through that student aid.

I might also suggest that if the five universities at this table could agree on doing the bookkeeping we could discover whether we're private or public. The cost of educating the student is about the same in the public institution, so that when it's supplied by State governments and private institutions are supplied by individual, but I think high quality universities cost about the same whether they're public or private.

Mr. JORDAN. That's right.

Mr. BENJAMIN. I wanted to add one thing to Mr. Simon's question. I think you have identified a very serious problem and one way to think about it would be to think about the following kind of idea: for every dollar that we invest in operating the excellence and the quality of our universities in terms of the subject today, we ought to be concerned with investing another dollar in equal access areas, affirmative action and so on, because otherwise I'm here touching on a very important point, we're simply going to turn our back on our concern for social justice in this country.

Mr. SIMON. Thank you.

Mr. MURPHY. Thank you very much.

From the National Institute of Education, Mr. Alan Wilson.

STATEMENT OF ALAN R. WILSON, ACTING DEPUTY DIRECTOR, NATIONAL INSTITUTE OF EDUCATION, U.S. DEPARTMENT OF EDUCATION

Mr. WILSON. Good morning, Mr. Chairman.

Mr. Chairman, at the outset let me express the regrets of the Director of NIE, Dr. Justiz, for his conflict of schedule and his inability to be here personally today.

Mr. MURPHY. If I may interrupt the witness to say that the head of NIE got his advanced degree at Southern Illinois University and, obviously, he's a man of great capacity.

Mr. WILSON. Mr. Chairman, postsecondary education in America is a $180 billion business, it represents fully 6 percent of our gross national product.

In any given year, it serves 12 million students in more than 3,300 colleges, community colleges, and universities.

There are more than 1 million individuals in education and training programs in the military and at least 5 million other citizens involved in formal education and training programs of American business, industry, public agencies, hospitals and unions.

And yet despite this considerable support our country provides to postsecondary education, knowledge of what students learn after high school, how they learn it and the educational practices which best serve their needs is sparse, fragmented and often inaccessible.

Earlier this year, the National Commission on Excellence in Education noted that large-scale research on college students has focused on every conceivable topic other than academic learning. Libraries are full of studies on how to improve teaching and enhance learning from the kindergarten level through high school; however, relatively few studies have been performed to improve postsecondary education.

Various theories regarding this phenomenon have been advanced. One common thought is that colleges and universities are, by their nature, research institutions. Through the years, it has been assumed that they would perform research on issues affecting all postsecondary education. This generally has not occurred.

Instead, colleges and universities have tended to conduct extensive research into how they can improve their own individual services and products as opposed to how they can improve postsecondary education as a whole.

The assumption that colleges and universities would handle the complete chore of researching the needs of higher education has resulted in government agencies and private foundations concentrating their efforts on studying ways to improve elementary and secondary education.

Evidence is mounting that there is now a particularly strong need for extensive efforts to find ways to improve postsecondary education.

Let me assert here that when I refer to postsecondary education, I'm talking about more than just colleges and universities.

Postsecondary education in today's world covers a broad range, which includes adult literacy programs, vocational-technical training, corporate training programs and much more.

Recent scores on standardized tests of college graduates indicate a higher rate of decline in achievement than standardized test scores of high school graduates.

Since 1965, for example, there has been a 16-percent decline in the scores on the verbal section of the Graduate Record Examination, compared to a 14-percent decline on the SAT/Verbal tests. Scores on the Graduate Record achievement tests in such subjects as English and history have gone down approximately 15 percent while scores in comparable fields on the college board achievement tests have remained relatively stable. Performance on the Graduate Management Admissions Test, which includes a huge number of business administration majors has fallen 6 percent.

Coincident with this decline in college achievement has been an increase in the number of corporate training and retraining programs.

Numerous employers testified before the Commission on Excellence concerning the necessity for retraining recent college graduates in subjects ranging from foreign languages to finance to communication skills of all kinds.

The decline in test scores and the need for retraining indicate that there is an increasing need for additional research into ways to improve postsecondary education.

In addressing this lack of postsecondary research, one mechanism that has extensive support among the education community

is the National Assessment for Education Progress which is administered by the National Institute of Education.

The congressionally authorized program currently assesses the educational progress of 9, 13, and 17 years old.

In the past, the assessment has studied the learning achievements of adults as old as 35. However, the program has reduced the scope of its research to only include, again, the 9, 13, and 17 years old.

If these Federal measurements of educational progress conclude when people reach the age of 17, we might give the impression that education and learning stops at age 17 as well.

The National Institute of Education is presently studying the possibility that NAEP do research on the learning achievements of young adults ages 21 to 35. This might be an important first step toward finding out what we can do to improve postsecondary education in America. Mr. Chairman, while most current research focuses on elementary and secondary education, I want to emphasize that the Institute is conducting some significant research affecting postsecond- ary education.

In September, the Institute formed a seven-member panel of distinguished educators to assess the quality of college-level education and help carry forth the work of the National Commission on Excellence in Education.

This important committee is in the process of identifying the additional knowledge that is needed to achieve excellence at the college and university level. The panel is keeping the Institute advised of its efforts and will submit a final report in the fall of 1984.

In addition, the Institute currently operates the National Center for Higher Education Management Systems in Boulder, Colo. The mission of this center is to improve the management of higher education at the State and institutional levels.

It's basic approach has been to provide higher education administrators with techniques for obtaining improved information for purposes of planning, budgeting and resource allocation.

During the past fiscal year, the center responded to more than 1,000 requests from colleges, universities and State agencies for analyses of enrollment, financial, and faculty data. The center also completed more than 20 research projects and journal articles on college effectiveness during the past year.

The Institute has also formed a national study group on postsecondary education to determine what areas our labs and centers should study in the coming years in an effort to improve higher education.

Finally, the Institute is also involved in adult literacy programs and a number of other activities affecting postsecondary education.

In conclusion, Mr. Chairman, we want to emphasize that valuable research efforts on postsecondary education are currently underway at the Institute, at colleges and universities and elsewhere throughout the country. Our challenge is to increase these efforts and to make the findings available to assist future generations of American students.

I would be happy to answer any questions you might have.

[Prepared statement of Alan R. Wilson follows:]

PREPARED STATEMENT OF ALAN R. WILSON, ACTING DEPUTY DIRECTOR, NATIONAL INSTITUTE OF EDUCATION, U.S. DEPARTMENT OF EDUCATION

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Yet, despite this considerable support our country provides to postsecondary education, knowledge of what students learn after high school, how they learn it and the educational practices which best serve their needs is sparse, fragmented and often inaccessible. Earlier this year, the National Commission on Excellence in Education noted that large-scale research on college students has focused on every conceivable topic other than academic learning. Libraries are full of studies on how to improve teaching and enhance learning from the kindergarten level through high school; however, relatively few studies have been performed to improve postsecondary education.

Various theories regarding this phenomenon have been advanced. One common thought is that colleges and universities are, by their nature, research institutions. Through the years, it has been assumed that they would perform research on issues affecting all postsecondary education. This generally hasn't occurred. Instead, colleges and universities have tended to conduct extensive research into how they can improve their own individual services and products as opposed to how they can improve postsecondary education as a whole.

This assumption that colleges and universities would handle the complete task of researching the needs of higher education has resulted in government agencies and private foundations concentrating their efforts on studying ways to improve elementary and secondary education.

Evidence is mounting that there is now a particularly strong need for extensive efforts to find ways to improve postsecondary education. Let me assert here that when I refer to "postsecondary education," I am talking about more than just colleges and universities. Postsecondary education in today's world covers a broad range, including adult literacy programs, vocational-technical training, corporate training programs and much more.

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This congressionally authorized program currently assesses the education progress of 9-year-olds, 13-year-olds and 17-year-olds. In the past, the assessment has studied the learning achievements of adults as old as 25. However, the program has reduced the scope of its research to only include 9-year-olds, 13-year-olds and 17-year-olds. If these Federal measurements of educational progress conclude when people reach the age of 17, we might give the impression that education and learning stop at age 17 as well.

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Mr. SIMON. Is it fair to compare trends in scores on standardized tests taken by college graduates for admission to graduate and professional schools with trends in scores on standardized tests taken by college-bound seniors for admission to college?

Mr. WILSON. In light of NIE's research, we believe that the two cases are comparable. Standardized tests taken at the high school and college levels are used as entrance exams to the next level of education. However, there are two major differences that must be considered when comparing standardized testing at the two levels of education: the variety of tests taken at each level and the size and percentage of the potential pool of people who take the tests.

Regarding the variety of tests, there are only two basic standardized tests normally taken by college-bound high school seniors: the SAT and the ACT (with very little overlap in the test-taking population between the two). However, college graduates applying to graduate and professional schools take a variety of standardized tests: the GRE, the GRE Achievement Test, the LSAT, the GMAT, the MCAT, etc. Each of these tests is geared to a different educational objective but they are all "entrance examinations."

With regard to those taking the tests, in 1982, the SAT and ACT were taken by approximately 1,900,000 high school seniors, or 65 percent of the 1982 graduating class. In comparison, approximately 600,000 people or approximately 50 percent of the potential pool of college graduates and soon-to-be graduates took the college-level achievement tests. Due to a variety of factors, such as the fact that not all of the people taking the tests were college seniors and the noncomparability of data on the characteristics of test-takers from one examination to another, we have used a different basis of estimation for those taking entrance tests for graduate and professional schools than for those taking the college entrance examination.

Thus, while the actual number of college graduates in any one year is approximately one-third the number of high school graduates, the percentage of the group taking the graduate tests is high enough (approximately 50 percent to justify analysis and comparison between the two groups).

Mr. MURPHY. Do you have data on whether education majors are staying in their field or moving to industry?

Mr. WILSON. The most recent data we have is for education B.A. recipients of 1976–77 who responded to a follow-up survey in February 1978. Some 49 percent of the group were employed as full-time teachers. An additional 11 percent were employed part-time as teachers (including some who were teaching as a second job). We have no additional information on the number of education majors who switch to other careers once they leave college.

Mr. SIMON. Do you have any comments on whether the overall achievement of college education majors is declining?

Mr. WILSON. The only test scores that provide historical data on this question are those of the Graduate Record Examination basic battery (shown below), Verbal (GRE-V) and Quantitative (GRE-Q). It should be noted, however, that not all education majors take the GREs.

Year	Education majors' mean scores		Undergraduate education majors taking test	Total number [1] of B.A.'s in education	Percent tested
	GRE-V	GRE-Q			
1975-76	451	449	22,709	154,759	14.7
1976-77	440	439	25,080	143,650	17.5
1977-78	433	438	27,422	136,079	20.2
1978-79	434	442	26,906	126,006	21.4
1979-80	431	438	26,862	114,102	23.5
1980-81	434	440	24,300		
1981-82	427	442	19,692		

[1] Not all education majors received their degree the year they took the GRE.

(Note.—The declines shown in these figures are in line with overall trends in GRE scores for all test-takers over the same period. What is particularly intriguing is the increase in percentage of undergraduate education majors taking the GRE. This may be due to job market conditions (the notion that one is more employable with a master's or doctoral degree) or a shift in the policies of admissions committees in graduate schools of education to require it. Alas, We can only speculate on the reasons.)

Mr. MURPHY. Thank you very much, Mr. Wilson.

I take it from your testimony that NIE intends to focus a greater emphasis on higher education in postsecondary. Is that what you're telling us?

Mr. WILSON. We have addressed the research agenda over the last several months with this in mind. We would like to emphasize postsecondary education more than we have in the past.

Mr. MURPHY. What percentage of NIE research has been focused on higher education up to this point? Do you have that?

Mr. WILSON. Yes, Mr. Chairman. In 1983, approximately 17 percent of our budget, or about $9.6 million went into the research, development, and dissemination of postsecondary and adult education.

Now, of that 17 percent, we would say that about 25 percent actually went to research; approximately 60 percent was for dissemination efforts; and about 15 percent went to development.

Mr. MURPHY. And are you proposing as you approach reauthorization to increase that percentage, the 17 percent or the 9.6 million?

Mr. WILSON. Well, the administration is currently developing its budget for fiscal year 1985 and how much of that budget will be redirected to those efforts I cannot say.

Mr. MURPHY. Are you asking for this in the coming year 1985 and what that increase will be?

Mr. WILSON. With the budget in the process of being developed, Mr. Chairman, I'm unable to say at this point what that request will reflect.

Mr. MURPHY. You have not been instructed by OMB or anyone to testify as to the amount, you're merely in the process now of formulating your 1985 budget, is that correct?

Mr. WILSON. That's correct.

Mr. MURPHY. And you will submit that to OMB?

Mr. WILSON. I believe the Department has submitted some documentation already to OMB.

Mr. Chairman, if I may, I would like to expand on the prospects of fiscal year 1985 in response to your question about the expansion of the role on postsecondary. One of the key activities in both 1983 and 1984 has been the design and planning for the recompetition of the laboratories and the centers, which are administered under NIE. Through that competition, we believe that we have the rare opportunity to both redirect and to make timely the research agenda for nearly all the labs and centers.

Since we expect that tens of millions of dollars of research and development will be supported annually through our labs and centers, we are studying very carefully the best way to use some of those funds in the field of postsecondary education.

Mr. MURPHY. Mr. Simon.

Mr. SIMON. Yes; you state that recent scores on standardized tests of college graduates indicate a higher rate of decline in achievement than standardized test scores of high school graduates. You may be correct in that assumption, although I'm not at all sure your documentation on the next page confirms that assumption, however, because you're talking about the entrance exams.

Harvard, for example, and I don't remember the figures exactly, but Harvard has found a decline in over a similar period of years, a decline in roughly from 80 percent of their summa cum laude students going into education down to 25 percent. These figures indicate clearly a decline in those who are going directly into education. It further indicates that, in fact, overall, college education achievement is declining in all cases. Do you have any comment?

Mr. WILSON. Mr. Chairman, those results are a compilation of numerous projects and data that have been collected at the institute, and whether the trend is verifiable or not, I think we can certainly submit those documentations; yes, sir.

Mr. SIMON. I would be interested in receiving additional information, because the statement is a fairly sweeping statement, and I would like to see any documentation you may have on that.

Mr. MURPHY. I would also. Perhaps our question is, Are a great percentage of the students now being channeled out of the institutions and into industry or—are they there and, if they are, where are they? Maybe we can find that out, because the statistics alone sort of condemn us.

Mr. WILSON. We will address that and send that to you.

Mr. SIMON. Then I like the idea that you hint at that you may go in this—this National System for Education Progress going in with this older group. I think that is highly important, and the adult literacy programs, this is a hidden monster in our society, and a great economic drain, a social drain, and anything you can do there ought to be encouraged. We appreciate the work NIE is doing.

Thank you, Mr. Chairman.

Mr. MURPHY. Thank you very much.

Thank you very much, Mr. Wilson, for coming to Pittsburgh.

The hearing is adjourned.

[Whereupon, at 12:15 p.m., the subcommittee was adjourned.]